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NOTES AND COMMENTS

Co-operation among Naturalists

We had barely space in our last number to chronicle the second annual congress of the South-Eastern Union of Scientific Societies. We have now received *The Transactions* of the Union for 1897, price one shilling. The Union already includes twenty-seven affiliated societies, and in carrying out its motto, "Co-operation not uniformity," is doing a really useful work. The papers and discussions at the congress were for the most part thoroughly practical. It is recognised, as we have so often pointed out, that there is a vast amount of labour wasted every year by enthusiastic naturalists, whose misfortune it is to have no friendly and enlightened guidance. The aim of such bodies as this Union is to co-ordinate scattered and wasted effort, and to direct it into profitable yet no less fascinating paths. Thus it is suggested that the Union shall form research committees to deal with special branches of scientific observation. These committees would be similar to those of the British Association, but they would confine themselves to local natural history. Like the Midland Union or the New Zealand Institute, such an union may become the publisher for all its affiliated societies, and thus exercise a much-needed editorial discretion. It can also organise lectures and lecture-apparatus, making a collection of lantern-slides to be borrowed from by any society; this is already being done by the S.E. Union. Again, there are many legal questions affecting naturalists and local societies, and these can best be dealt with by a strong corporate body. The present congress discussed one such question, namely, "How can the Technical Education Grant assist local societies?" It appears that it is out of the question to ask for direct pecuniary assistance; but there seems no reason in justice or equity why local societies, engaged as they are in the education of the public, should not be allowed the use of a room in buildings erected with public money for purposes of

technical education, and we trust that on this matter the Union may be able to enter into cordial relations with the County Councils.

Government and Provincial Museums

THE meeting of the Museums Association, held this year at Oxford, July 6-9, was not largely attended, and did not produce a plentiful crop of papers. Even those that were submitted were not all read, owing to the necessity this Association always feels itself under of curtailing within narrow limits the time devoted to their reading and discussion.

The chief discussion took place on Prof. Flinders Petrie's suggestion of a federal staff for museums; by which he means that small curators should be abolished, their place being supplied by caretakers, and their work being done by peripatetic specialists. The proposal was thought impracticable; but there is no doubt that more might be done to encourage co-operation. There are two schemes that suggest themselves as the kind of ideals towards which we might strive. One is that each curator of a small provincial museum should endeavour to become thoroughly competent in some one branch of his work, and that for two or three months in each year he should change places with his fellow-curator from another museum—equally competent, but in another subject. Thus the museum, while paying one curator, would as years passed obtain the experience of a dozen. The alternative plan that occurs to us is that the staffs of the notoriously under-manned government museums should be increased, and that it should be part of the official duty of each specialist-curator to work for two or three months of each year at provincial museums. Government would, of course, have to levy some tribute from the provincial centres, to be applied to the salaries of the government officials; but apart from this there would be a gain to the specialist, to the head museum, and to the country, by the co-ordination, investigation, and effective utilisation of all our obscured scientific and artistic material, as well as by the increased sympathies, knowledge, and experience of the specialist.

At present government officials seem to hold somewhat aloof from the provincial museums, and from the Museums Association. Whether it be that the hard-worked civil servant can ill spare days from his holiday merely to talk shop, whether he thinks he will learn nothing from these meetings, or whether he really takes no interest in his life-work beyond the drawing of his salary, we do not know. At any rate the Museums Association recognises that it, for its part, has much to learn from the keepers and assistants in our larger museums, and it wishes that government officials could be

given facilities for attending the yearly meeting not less than those accorded to nearly all provincial curators by the much-abused town and county councils.

The Protection of our Fauna and Flora

We have heard a good deal lately, both from naturalists and those whom the world in its rude way calls faddists, about the extermination of many of our native plants and animals. There is, unfortunately, little room for doubt that, however ill-advised may be the action of certain enthusiasts, their fears are on the whole well founded. "Naturam expellas furca, tamen usque recurrit," is only true up to a point: and when 'furca' has to be translated 'bricklayer's trowel,' that point has been passed. Those who wish to preserve at least a sample of what was once English country should read the level-headed paper sent by the Rev. J. J. Scargill of Bromley to the Congress of the South-Eastern Union. Here is a suggestion of his: "There are, perhaps, a dozen animals, furred or feathered, that are habitually killed by keepers. Let a man devote himself to investigating the habits (of course, in its wild state) of one of these—hawk, owl or magpie, stoat or weasel —noting all that it feeds on, and recording his observations day by day. In a few years, and with a sufficient number of observers, a fair estimate of the truth might be arrived at. It would be no easy task, but it would be good 'naturalists' work' worthy the attention of any follower of Darwin."

The want of thought that works so much ill can only be checked by the creation of a public conscience. "There are," says Mr Scargill, "several obvious means—1st, County Councils should be active in exercising their powers under the Act of last year, and prohibit altogether the taking or killing of such birds as those just mentioned; 2nd, the editors of natural history magazines should never let an issue pass without a few words on the subject; 3rd, instruction on the duty and the reasons for it should be periodically given in every school."

As for the naturalists themselves, especially those whom Mr Scargill describes as "the camp-followers of science, eager for the loot, but inclined to shirk the discipline," they may remedy matters in two ways. First, let them collect only for their local museum, and themselves pay more attention to the habits or the structure of the animals and plants they meet with; secondly, let them leave the butterflies and the petaliferous plants alone for a time: they will find the flies, the grasses, the mosses, the marine invertebrates quite as interesting and far more profitable. Let us add that there is never any harm in collecting fossils, for they are dead

already; it is only necessary to keep careful account of locality and horizon, and to spare the fossiliferous stones of ancient buildings. There is plenty of sport in fossil-hunting, and the merest of mere collectors may provide the most philosophical of palaeontologists with valuable material, and in this way increase the value of his own collection.

Frou-frou and Feathers

All moralists have assured us that "when lovely woman stoops to folly," she stoops very low indeed. And so when women attempt to emulate the glories of a Choctaw chief or a South Sea islander, it is not considerations of art or humanity or self-respect that will stop them. Consequently it is not likely that the insensate votaries of fashion, who disfigure their heads with baskets of artificial flowers (irrespective of the season), virulently dyed scraps of ribbon, twists of steel, and unnaturally clipped or coloured bird-feathers, will pay any attention to a paragraph in a scientific journal. But we are willing to leave the irresponsible half of creation all their *chiffons* (which mean 'rags' or 'women's dress' as you please), their coal-tar dyes, and their scrap-iron, if only they will leave us our birds. The rate at which some of the rarest and most beautiful birds on our planet are being destroyed to gratify this extraordinary taste can hardly be realised. On the 13th of April last nearly half-a-million birds were sold at an auction in London, and the details of the consignment were thus given by Mrs Edward Phillips at the annual meeting of the Selborne Society:—

Osprey plumes,	11,352	ounces
Vulture plumes,	186¾	pounds
Peacock feathers,	215,051	bundles
Birds of Paradise,	2,362	
Indian parrots,	228,289	
Bronze pigeons, including the goura,	1,677	
Tannagers and sundry birds,	38,198	
Humming birds,	116,490	
Jays and kingfishers,	48,759	
Impeyan and other pheasant and jungle fowl,	4,952	
Owls and hawks,	7,163	

A similar sale took place in February, and others were to follow in July and October.

It is small consolation to us to think that in a few years the price of these luxuries will be prohibitive, or that, unless fashion changes in the direction of sea-weeds or turnip-tops, there will soon

be no more birds to destroy. Nor can we overlook the terrible suffering involved by this enormous slaughter: the young osprey bereft of its parents left to die in hundreds, the heron with the plumes torn from its back, writhing into death. But Frou-frou cares for these things no more than she does for the squalor of East-end sweating-dens. Dear delightful doll that she is, she actually attends a meeting of the Selborne Society with aigrettes in her bonnet.

What can we do? Frou-frou does not read *Natural Science*. But at all events each of our many thousand readers must enjoy the acquaintance of many ladies. He can at least use his influence in a quiet way in the home-circle, if not beyond it. If each of us will make sure of a few facts, and keep pegging away, perhaps we may even make converts, and so widen the small circle of our influence.

National Geology

The annual report of the Geological Survey of the United Kingdom for 1896 reaches us in its handy separate form, and each year's issue contains a wealth of information about our islands. Sir A. Geikie's far-seeing policy of attaching to the Survey men already qualified by original research must tend to increase still further the scientific character of its publications. Though the results may never appear in so handsome and truly national a form as do those of the United States, yet this annual summary shows strikingly the character of the work in hand. Teachers can now, for the sum of sixpence, keep abreast of the advances made by the Survey in England, Scotland, and Ireland; and, as all practical workers know, these advances often concern even the broader boundaries on the map. The classification of results in this year's report under the several geological systems makes reference easy through its hundred closely-printed pages. We would especially direct attention to the progress of knowledge with regard to the pre-Cambrian and older Palaeozoic groups. The occurrence of widely-spread diabasic lavas with 'pillow-structure' (p. 37), and of two abnormal short-lived volcanoes in Raasay (p. 74), may be cited as among the interesting igneous problems dealt with. One of the most important stratigraphical questions is the relation of the 'Upper Greensand' to the Upper Gault, referred to on p. 72.

It is obviously impossible to continually re-edit the engraved maps of the Survey so as to embody current progress. If our Parliamentary legislators, however, were more frequently trained in scientific schools, they would find much to be proud of in these annual reports, and would congratulate the State and them-

selves on that zeal for discovery which raises the work of a public department into one of international distinction.

Microscopy in Manchester

The Manchester Microscopical Society has recently issued its "Transactions and Annual Report" for 1896, and an excellent little publication it is. To our way of thinking it is almost a model of what such a publication should be. Without claiming to contain the results of elaborate original research, the papers are nevertheless of a very useful and suggestive nature. Prof. Weiss, of Owens College, in his presidential address gives a very good account of the main facts known of the biology of those, from some points of view, exceedingly familiar organisms, the diatoms. We believe that the type of microscopist known a few years back as the 'Diatomaniac' is wellnigh extinct, but if a few individuals of the species still exist we feel sure a perusal of Prof. Weiss's paper would do much to broaden their views of things in general and of diatoms in particular. We heartily endorse the sentiment of Prof. Weiss when he says, "I should like to plead for the union of two branches of study, the systematic and the physiological or biological, the severance of which is greatly to be regretted, and has proved wherever it occurs to be a hindrance to the real progress of Natural Science." Other papers in the *Transactions* deal with "The Method of Reproduction in Plants," more especially the microscopical forms, "The Structure and Development of the Hydrozoa," "The Lace-work Sponge," "The Defensive Devices of Lepidopterous Larvae," "The Entomology of the Oak," and "The Distribution of the Fresh-water Fauna." The latter is by Prof. S. J. Hickson, and contains many most interesting facts and suggestions. Prof. Hickson considers that the facts of distribution teach us that fresh-water animals may be divided into three groups: (1) the Cosmopolitan group, including the large majority of fresh-water species; (2) the Archaic group, represented by such forms as *Apus* and *Limnocodium*; and (3) the Recent group, comprising species which have only recently migrated into fresh water, such as *Cordylophora* and some of the prawns. The problems to which this paper draws our attention increase our regret that this country is still without any prospect of a fresh-water biological station.

Altogether, judging from the papers and report, the Manchester Microscopical Society seems to be in a very vigorous condition, which is something to be thankful for in these latter days when local societies are too often more asleep than awake.

The Apparent Disappearance of the British Phyllopods

In the course of the paper alluded to above Prof. Hickson makes the very positive statement that the phyllopod *Apus* does not occur at all in the British Isles. This may be true, in fact we are almost forced to believe that it is true; but it is also certain that this animal used to live in this country, for Dr Baird records it as having been taken by three different observers, although he does not appear to have found it himself. Since the publication of the "Natural History of the British Entomostraca" in 1850, *Apus cancriformis* has never again been recorded, so far as we are aware, and it does seem almost certain that it has totally disappeared from our fauna. The same fate also seems to have overtaken the brine-shrimp, *Artemia salina*. In Baird's time this form was to be found in the 'salt-pans' at Lymington, and probably other places, but at the present day one may search the old 'salterns' in vain for any trace of the creature. With regard to the beautiful *Chirocephalus diaphanus*, which Baird mentions from a large number of localities, the facts scarcely warrant our regarding it as totally extinct. It has certainly been seen several times since 1850. Prof. G. S. Brady mentions it from Yorkshire, and more recently it has been taken near Birmingham; nevertheless for all practical purposes it now appears to have disappeared. We should, however, be exceedingly glad to hear if any of our readers have taken this form, say, within the last ten years.

Prof. Hickson attributes this dying out of Phyllopoda—he refers to *Apus* more particularly—to the very limited means of dispersal which these creatures have at command. They are comparatively large forms, and cannot therefore be transported, attached to birds' legs, &c., so readily as the smaller and commoner Entomostraca. In addition to this they do not produce specially protected eggs like many of the Daphnias, &c. It seems probable, therefore, that, not being provided with the means of transport found in the cosmopolitan fresh-water forms, the phyllopods have not been able to extend their geographical distribution, while owing to the drying up of old lakes, and other changes, the localities in which they occur are becoming fewer and fewer.

The Bibliography of Science

Of course we are glad to find that Mr Arctowski's article on the Genealogy of the Sciences, which appeared in *Natural Science* for June 1897, should so have pleased the editors of the *Bulletin de l'Institut International de Bibliographie* that they should have published a French version of it in their number just received by us.

None the less we are surprised that a journal with so high-sounding a title should so ignore the objects of its existence and the responsibilities that it has assumed, as entirely to omit all reference to the original place of publication of the article. We may also point out the absence of an exact date of publication from the wrapper, the pages, and the included catalogue-slips of this *Bulletin*. To parody an old saying, we must really cry, "Bibliographer! bibliograph thyself."

The Belgian bibliographers seem to have found Mr Arctowski's article as unpractical as interesting. One thing is certain, we are not going to wait—not even the Royal Society Committee—for someone to write us a phylogenetic history of science. Therefore the impossibilities of the suggested classification do not greatly matter. At the present moment work is being done in the bibliography of science on a definite and uniform plan, which may be ridiculous, incorrect, confusing, but which is workable and being worked. There are no doubt plenty of beautiful, symmetrical schemes, as clear as daylight, but they are not in use. The following bibliographies are announced by the *Institut International* in a catalogue of its publications:—Bibliographia Philosophica, B. Sociologica, B. Astronomica, B. Zoologica, B. Medica Italica, B. Anatomica, B. Physiologica, B. Ostetrica e Ginecologica Italiana, while there are in preparation a Bibliographica Geologica, B. Physica, B. Medica Belgica, B. Agronomica Italica, and others.

Some of these bibliographies represent the adhesion to the uniform plan of periodicals or societies hitherto working on other lines, such as the *Zoologischer Anzeiger*, *Anatomischer Anzeiger*, and *Il Policlinico*. We notice too that the Biological Society of Paris accompanies its 1896 volume with an analytical index to the articles, arranged on the principles of the decimal classification. All the subjects dealt with in over 300 articles are thus referred to in two pages. These and numerous other facts, which it would be wearisome to detail, show that the system is gaining ground, whereat many will marvel.

A Biological Record

Yet another form of scientific bibliography comes to us in *L'Année Biologique*, further described as "comptes rendus annuels des travaux de biologie générale publiés sous la direction de Yves Delage, professeur a la Sorbonne avec la collaboration d'un Comité de Rédacteurs." The secretary to the editors is Dr Georges Poirault. The work is published by Schleicher Frères, 15 Rue des Saints-Pères, Paris, at a price of 20 francs. The first volume, just received by us, deals with the literature of the year 1895. We may describe

it by saying that it treats of those papers that are noted by the zeal of Mr J. Arthur Thomson in the first section of our own *Zoological Record*, and that the plan of the work is like that of the *Zoologischer Jahresbericht* and the *Neues Jahrbuch für Mineralogie* combined. There are 53 collaborators, mostly French, so that the task of abstracting is pretty sure to fall into competent hands. The want of correlation to which this leads is compensated by the several introductions as well as by special articles on general subjects—*e.g.*, on grafting, by L. Daniel; experimental knowledge of the correlation of animal functions, by E. Gley; on polyzoism, by J. P. Durand.

As to what is meant by biology, there is always a quarrel simmering. It is not long since we received an elaborate discussion of the subject from Mr Henry de Varigny, extracted from the "Dictionnaire de Physiologie." He defined it as "the science of the relations of organisms to the environment and to other organisms, present and past." Professor Delage, in his Preface to the present work, does not waste much time in discussing what is or is not biology; for practical purposes, as a criterion of what shall be included in *L'Année Biologique*, he accepts every paper that professes to give an explanation of biological phenomena (*i.e.*, of the phenomena of living beings). It is easy for an analyser or recorder to see whether an author professes to explain. But Prof. Delage has opened a loop-hole for complaint, since he also promises to record facts that may be connected with some future explanation, or even those which "belong to general biology, and are not of the same nature as others already known." Who is to decide what facts will ultimately be of value in the explanation of our ever-varying problems? Each day has its own burning question, casting others into the shade; and what the riddle of to-morrow may be we know not. Facts that were passed over a few years ago are all-important now. What facts shall we be collecting twenty years hence? But, apart from this difficulty, only to be overcome by a prophet, there is the certainty that hundreds of facts undoubtedly worthy of record from Prof. Delage's point of view, will be overlooked by himself and his collaborators. It does not take us five minutes to discover a score of such facts, published during 1895, often with full knowledge of their import, but nowhere alluded to in this volume. We do not blame their omission, for we cannot think that anything else is to be expected on the present system of compiling bibliographies.

Taking this work for what it really is, and not for its unattainable ideal, we recognise that it is relatively complete; that it is well arranged and well executed, profiting by the experience of predecessors. It is an aid that should be neglected by none with a

soul above species-mongering and section-cutting; in other words, it will be welcome to all readers of *Natural Science*.

Natural Science in Japan

The historian of science in Japan is too apt to restrict his view to the influence of European science, to the introduction of Newtonian and Darwinian philosophy and of the Linnean system, forgetful that there were philosophies and systems in the Far East centuries before, or else thinking wrongly that these were of small account. In an admirable Introduction to the first number of *Annotationes Zoologicae Japonenses*, Prof. K. Mitsukuri corrects this error. Early in the eighth century of the Christian era there was already established in Japan an Imperial University with 400 students, devoted to Ethics, History, Jurisprudence, and Mathematics. There was also an office for Astronomy, Astrology, Calendar-compilation, and Meteorology, as well as a Medical College with professors of Medicine, Surgery, Acupuncture, Necromancy (the art of healing by charms), and Pharmacology. In connection with the last-named branch of study, much botanical information was acquired. Towards the end of the ninth century the large Imperial library contained numerous medical works, among others, on the diseases of women and the diseases of the horse. In later times, under the Tokugawa Shoguns, natural history, especially botany, was extensively studied, and elaborate works were published, of which Prof. Mitsukuri instances the 'Shobutsu Ruisan' issued early in the eighteenth century, and the "Honzō Kōmoku Keimō" by the celebrated teacher of natural history, Ono Ranzan, published in 1803. *Honzō*, which strictly means botany, seems to have come to include general natural history, for many of these works deal also with stones, metals, and all kinds of animals. In Rosny's "Catalogue de la Bibliothèque Japonaise de Nordenskiöld" we even find a note on fossil shells, which appeared so early as 1725. The naturalists also held meetings at which they exhibited their treasures to one another and to the public. The Garden of Medicinal plants at Tokyo was established in 1681.

It was during the eighteenth century that western science first came into contact with the Japanese, through the medium of the Dutch language. The story of this and of the gradual development of modern science in Japan has already been told in our pages by Mr F. A. Bather (vol. iv., Jan., Feb., and March 1894); but many details are added by Prof. Mitsukuri. Zoology, he notices, had developed but slightly before the restoration of the Mikado in 1868; it was not till the appointment of Prof. E. S. Morse to the Chair of Zoology at Tokyo University, in 1877, that it made any progress

The indefatigable American popularised the science, secured a band of earnest students, established a museum, and organized the Tokyo Biological Society, now the Zoological Society. He was succeeded by C. O. Whitman, who introduced modern technical methods.

Since 1881 the development of zoology in Japan has been entirely in native hands, and does not seem to have suffered from that cause. All its main branches, including its practical applications, are now fairly represented. The Marine Station at Misaki has been outgrown, and a larger one is being opened two miles north of the present building. The teaching of zoology in the various schools over the country is a recognised thing. Further, the addition of Formosa to the territory of Japan has already been taken advantage of by Japanese zoologists. One thing is wanted, and that is literature. Prof. Mitsukuri appeals to the naturalists of other countries to send their publications to the Imperial University, where they are sure to be warmly appreciated.

Growth-Changes in the Spicules of Sea-Cucumbers

The sea-cucumber, trepang, beche-de-mer, or holothurian, is well known to be a favourite article of food in the Far East; especially is this the case with the common *namako* of Japan. For the protection and cultivation of this animal, Prof. Mitsukuri some time ago began an inquiry, at the instance of the Ministry of Agriculture and Commerce. One of the first questions to be answered was the number of species, if there were, as was supposed, more than one. The species of holothurians are often determined largely by differences in the form of the minute calcareous spicules found in the skin. Now it so happened that those who had examined this Japanese holothurian—namely, Selenka, Von Marenzeller, Lampert, and Théel—had failed to find the same appearances in the spicules, and had founded two species, *Stichopus armatus* and *S. japonicus*, together with a variety of the latter, called *typicus*. The shape of the spicules is that of a minute one-legged table made of open fretwork; but some individuals contain no tables at all, only smaller spicules something like round buttons with four or five holes in the middle. Prof. Mitsukuri's investigations, now published in *Annotationes Zoologicae Japonenses* (i. pp. 31-42), show that all these forms belong to *Stichopus japonicus*, and that in this species the form of the spicules changes with advancing age. The youngest individuals have an extremely large number of most perfectly formed large-sized tables, and nothing but these. With the growth of the animal, perfectly formed tables decrease both in number and size, and tables in various stages of arrested development are found mixed with them. This process continues with age, until in fully grown

individuals there are found nothing but the small plates above-mentioned. These represent a small part of the original table top, and are comparatively thinly scattered in the skin.

In the youngest stages the calcareous deposits are the most complete, and have almost the character of a coat of armour, like that of a star-fish or sea-urchin. This may be for the greater protection of the young, in which the skin and muscle-layers are very thin and pliable; but it may signify the descent of the species from a more richly plated ancestor. These differences are not entirely signs of age, but, in conjunction with others, distinguish geographical races. Thus forms with spicules in the shape of buttons are more common in the north of Japan, and are also characterised by numerous long-pointed papillae set in four rows along the back and sides, with many smaller papillae between them. As one passes southwards along the coast one comes gradually to forms that have only a row of low papillae along the sides, and a few scattered over the back. Habitat, however, has its influence no less than latitude. Those that live among rocks have a larger number of tall papillae, and are of a mottled brown colour, while those that live on sandy ground, probably among sea-weeds, have lower and fewer papillae, and are of a dark-green colour.

This interesting and doubly important paper makes one doubt afresh the validity of the many species of holothurians that have been based on the examination of the spicules of a few individuals; it shows the necessity for the examination of many specimens in various stages of growth from different localities; and it affords one more demonstration of the value of the study of all growth-changes and not merely of those that occur in the embryo.

How a Brittle-Star Lives in Japan

While the Japanese zoologists, K. Mitsukuri and T. Hara, were on a collecting tour last year, they came, on April 1, to a sandy shoal in the Bay of Kagoshima. Wading into the water, they were soon struck by very curious objects. "Numerous slender stalks a few millimeters in diameter and 10-15 centimeters high were standing up from the bottom, looking like the stems of so many weeds. Along one side of each stalk there was, however, a row of white papillae-like structures. These stalks were mostly by twos, although sometimes only one was standing by itself. We do not remember having seen three making a group. As we dug, to learn more about these curious objects, we were greatly surprised to find that they were the arms of ophiurans, and that the papilla-like structures were, therefore, no doubt, tubefeet. So far as we could see there was no difference between the five arms of the animal, and why only one or

two of them should be thus thrust upwards into the water, and kept upright there, was a mystery. It seemed probable to us that it was done to secure respiration. The sand of the shoal was literally packed with these animals, and there must have been hundreds of thousands or, perhaps, millions in the whole shallow." The species was near or in the genus *Ophiopsila*. The account is extracted from the miscellaneous notes in the first number of *Annotationes Zoologicae Japonenses*.

A Botanical Discovery from Japan

Botanists became greatly excited when, several years ago, Treub published an account of his discovery of Chalazogamy in *Casuarina*. By this term, as our readers may remember (see *Natural Science*, vol. i., p. 132) he described a method of pollination, in which the pollen-tube entered the ovule through the chalaza instead of at the micropyle. Treub was so much impressed with the importance of this and other deviations from the normal course of events in *Casuarina* that he separated it from the rest of the seed-plants under the name *Chalazogamae*, the latter, in which presumably pollination was effected through the micropyle, forming the *Porogamae*. More recent work has shown this revision of our classification to be unnecessary, and that *Casuarina*, though certainly presenting remarkable anomalies, must still be retained among Dicotyledonous Angiosperms.

There has recently come from the far East news, and confirmation of the news, of a yet more startling discovery. S. Ikeno and S. Hirase, working at Tokyo in Japan, have found that in the process of fertilisation in *Cycas* and *Gingko* the male element (generative nucleus) is converted before its escape from the pollen-tube, into a motile spermatozoid. This swims through a quantity of sap occurring in these genera between the embryo sac and the top of the nucleus which forms a thin papery covering for the contents of the ovule, and impregnation of the oosphere is therefore effected in the same manner as in the Vascular Cryptogams. The spermatozoids are much larger than hitherto known among the Cryptogams, and that of *Cycas* is larger than that of *Gingko*. The shape is oval. The head consists of three spiral windings in *Gingko*, and of four in *Cycas*, and bears numerous motile cilia. The great importance of the discovery of the Japanese botanists lies in the fact that it strengthens our present system of classification. Hofmeister showed the near relation subsisting between Gymnosperms and Vascular Cryptogams working chiefly from the development of the female spore (embryo-sac) and the structures resulting therefrom. Now from the male side comes a striking confirmation of his conclusions,—a confirma-

tion which, as Messrs Ikeno and Hirase point out, Hofmeister had suggested would be forthcoming. It is of much interest that Conifers represented by *Gingko*, as well as Cycads, show this relation; as we have always been wont to consider the latter so much the more ancient group both on palaeontological and morphological grounds. And *Gingko*, the maiden-hair tree, which with its strange fern-like foliage and non-conelike inflorescence, has always attracted us, will become still more fascinating. The confirmation of the news to which we have referred was supplied by Dr Scott, who at the last meeting of the Linnean Society showed actual microscopic preparations which he had received from Japan. A few more details will be found in a note communicated by the discoverers to the June number of the *Annals of Botany*.

Fungi and their Hosts

It is generally understood that a fungus, when parasitic, preys upon one and the same host during the whole period of its life-history. Hitherto only a single exception to this rule has been recorded, namely, that of certain 'rusts' (Uredineae), whose heteroecism (as change of host is technically termed) was first demonstrated satisfactorily by De Bary in 1864. Now, however, the Russian botanists Woronin and Nawaschin (*Zeitschr. für Pflanzenkrankenheiten*, vol. vi., 1896, pp. 129, 199) have discovered an interesting case of the same exceptional phenomenon, namely, in a new species of the Ascomycetes which they have described and named *Sclerotinia heteroica*. The resting-stage (or Sclerotium) giving rise to the *Peziza*-form grows in the capsules of *Ledum palustre;* the other (or conidial) form they found as a destructive parasite on the leaves of *Vaccinium uliginosum*. The fruit of *Ledum palustre* is attacked at an early stage of its growth, and is gradually replaced by the sclerotium. The diseased capsules, which do not differ much in appearance from the healthy fruits, remain attached to the parent plant during the winter, and fall to the ground in spring when the stalked cup-shaped ascus-fruits are developed. The ascus spores, scattered by the wind, light on the buds and young leaves of *Vaccinium*, where they germinate and spread through the cells of the plant. The conidial fructification, upright stalks with branched chains of conidia, appear on the petiole and veins of the leaves, which turn brown and gradually die. The authors by repeated experiments established without doubt the relation between the two forms; but it is rather remarkable that they were able to cultivate the conidial form from the ascus spores on a decoction of plums; and this fact, as pointed out by Fischer, interferes between the parallel with the above case and that of the Uredineae. The

latter are obligative parasites, and no culture medium has been substituted at any stage for the living host plants.

There are a number of parasites among the 'Fungi imperfecti' which may prove to be heteroecious forms of parasitic ascomycetes, and it would be well worth while to carry out further experiments on the subject.

A Bacterium Living in Alcohol

During the last year much of the rum manufactured in Demerara has been found to be 'faulty,' and, the cause having been sought for in vain, great loss has resulted to the colony. Mr and Mrs Victor H. Veley, of Oxford, have recently discovered a micro-organism in some samples of faulty rum sent them for examination. The bacterium belongs to the group *Coccaceae*, adopting Zopf's classification, and is probably a new species. Mr and Mrs Veley have already obtained several stages in the life-history, by cultivation, and hope shortly to publish an account of its development and the chemical changes which it produces in the liquid. The fact of any micro-organisms existing and multiplying in spirit correctly assessed at 42° over proof, or about 74·6 % by weight, is of great interest both from a scientific and technical point of view, and the investigation is likely to prove of considerable importance.

John Jeffrey

In the *Proceedings* of the Biological Society of Washington (vol. xi., pp. 57-60), Mr F. V. Coville gives a sketch of the route taken by John Jeffrey, "one of the most obscure" of the botanical explorers who have done important work in North America. Botanists know him only as the subject of the dedication of a Californian pine (*Pinus jeffreyi*), described by Andrew Murray from material sent home by Jeffrey. The brief account of his work as a traveller and collector has been drawn up by Mr Coville by the aid of documents both manuscript and printed, which have hitherto been almost unknown, or at any rate unexamined. We know that Jeffrey was a Scotsman, and that in 1850 he was sent to North America under the auspices of an organisation formed in Edinburgh, with Prof. J. H. Balfour as chairman, and known as the "Oregon Botanical Association." He was to go to Western North America, and collect the seeds of trees, shrubs, and other plants suitable for horticultural purposes, in the region traversed by David Douglas, "to complete his researches, and to extend them into those parts of the country not fully explored by him." Starting from York Factory on Hudson Bay in August 1850,

he worked by way of the Saskatchewan and Athabasca rivers to the Rocky Mountains, which he crossed between Mounts Brown and Hooker, and then descended the Columbia river to Fort Colville. He arrived at this place in May 1851. The next two years were spent in exploring the coast region between the Fraser river and San Francisco. Collections were made on Mount Baker, the Cascade Mountains, the Sierra Nevada, and other ranges in Southern Oregon and California, and along many of the river valleys. Several collections were sent to Edinburgh, the last being those made in 1853, when his term of employment by the association ceased, the original contract being for three years' service. A letter to Andrew Murray from a brother in San Francisco, dated May 1854, gives the last information we have of a hard-working and enthusiastic but ill-fated botanist. He planned an expedition to Fort Yuma on the Gila river in Colorado, from which he never returned, and there seems little doubt that he perished of thirst in the desert.

The Camel in Europe

It is difficult to determine the natural geographical distribution of an animal which has been so long domesticated as the camel. Discoveries of its remains in surface-deposits need to be carefully investigated by competent geologists before they can be accepted as actual fossils, not as bones merely buried by man. Great interest therefore attaches to an announcement by Dr G. Stefanescu, the eminent Roumanian geologist, of the discovery of two portions of the mandible of a species of *Camelus* in an undoubted Quaternary gravel, six metres below the surface, on the river bank of the Olt at Milcovul-de-jos, near Slatina, Roumania (*Anuarulu Mus. Geol.*, Bucharest, 1895). Dr Stefanescu disinterred the specimens himself, and there can be no doubt as to their geological age. He regards the species to which they belong as new, and names it *Camelus alutensis*. We believe that there are similar fragments from the Volga basin in the collection of Prof. A. Rosenberg of Dorpat (Jurjeff), but we are not aware whether any account of these has been published.

Steenstrup

We regret to record the death of the *doyen* of Danish zoologists, the veteran Prof. Steenstrup. We hope next month to publish a short account of his life and work by Prof. Chr. F. Lütken, with a recent portrait.

I

The Influence of Woman in the Evolution of the Human Race

THE recent discussions of Mr Reid's book, "The Present Evolution of Man," in *Natural Science* (vol. x., pp. 184, 242, 305, 393) have interested me, both on account of their able treatment of this subject from so many different sides and also on account of their omissions of certain points of view. Man's place in nature, the possible influence on his destiny of the position he occupies as the terminal form of his own group, should, it seems to me, be given more consideration as a possible factor in his evolution. This has received incidental consideration by the writer in connection with studies upon the phenomena of evolution among the Invertebrata, especially Cephalopoda, and the results are instructive and quite similar to those reached by the distinguished English palaeontologist, Mr S. S. Buckman.

The way in which man's position may possibly affect his evolution and further prospects has been treated by the writer in a lecture upon "Woman's Occupations and Habits and the Suffrage from a Biological Point of View." This can be used as an example of a certain mode of treating the subject, and an abstract of this lecture may perhaps interest the readers of *Natural Science*. It is also appropriate that it should appear first in an English periodical, since, if the reports are true which reach this side of the ocean, some leading Englishmen are so sadly deficient in knowledge of the subject and its importance, that they consider the question of whether the suffrage shall or shall not be granted to women as a huge political joke rather than as a question dealing with matters of importance to the future evolution of civilised races. People do not yet recognise that the tendency of evolution is quite as often towards retrogression and extinction as in the direction of progression; the former indeed being the final result both in the life-history of the individual and of his family, and finally of the race to which he belongs. The laws of biology have not hitherto been used to test the assumptions, that co-education and the changes of occupations and habits induced thereby and by the legal freedom of choice of occupation conferred by the use of suffrage upon women, will be beneficial factors in the evolution of the future. The writer has thus been endeavouring to call attention to this side of these

questions in Boston and Cambridge, U.S.A., and the following is a brief abstract of the arguments employed in the lecture referred to, lately delivered in these two cities.

(1) Men and women, like the males and females of most animals, show by their organisation that they have been evolved from a type in which both sexes were combined in the same individual. The separation of the sexes did not destroy this dual nature, as is demonstrated by the development of secondary male characters in the old age of many species of animals and of women in extreme age, and of feminine characters in aged men. This opinion can also be supported by the structure of the tissue cells in the body, the nuclei of which are made up of paternal and maternal parts. This dual structure enables us to understand the fact that secondary sexual characters are latent in both males and females, and liable to make their appearance after the reproductive period is passed through, or before this time and prematurely in abnormal individuals, or perhaps under certain conditions of habit or surroundings.

The maternal (in larger degree or wholly feminine) parts of the nuclei are certainly prepotent during the entire reproductive or adult stage of growth, and their constant employment in the performance of feminine functions prevents the development of latent male characters. During this time the paternal (in larger degree or wholly male) parts of the nuclei have remained inert and may be supposed to be still capable of multiplying by division and producing extra growths, thus even in old age building up secondary male characters, such as the comb, wattles, etc., in some birds, or giving rise to secondary male characteristics in old women. This may also take place prematurely through suppression of the natural functions, either by change of habits or by surgical or other artificial operations. These statements apply equally well to men, and some of the most remarkable examples are to be found in this sex, but the dangers of feminisation to the men, although possibly greater than we now suppose, do not seem at least to be so important or threatening as those that lie in the possible future of the women. These are striking out into new paths, and are being helped by men who are equally ignorant with themselves of the nature of their own organisation and of the possible dangers to their race of the success of their efforts.

(2) In the early history of mankind the women and men led lives more nearly alike and were consequently more alike physically and mentally, than they have become subsequently in the history of highly civilised peoples. This divergence of the sexes is a marked characteristic of progression among highly civilised races. Co-education of the sexes, occupations of certain kinds, and woman

suffrage may have a tendency to approximate the ideals, the lives, and the habits of women to those of men in these same highly civilised races.

(3) Such approximations in the future, while perfectly natural and not in a common sense degenerative, would not belong to the progressive stages of the evolution of mankind. Such changes would be convergences in structure and character, and, although they might lead to what we might now consider as intellectual advance, this would not in any way alter the facts that women would be tending to become virified * and men to become effeminised, and both would have, therefore, entered upon the retrogressive period of their evolution. The danger that men may become effeminised may be greater than would at first sight seem probable, but this might not take place at all or to such a slight extent as not to affect seriously the progressive evolution of the race. On the other hand, the danger to women cannot be exaggerated nor too carefully considered, in view of the fact that advanced women have adopted the standards of men, and have not tried as yet to originate feminine ideals to guide them in their new careers and thus maintain the progressive divergence of the sexes.

(4) There is a rise of the individual through progressive stages of development to the adult and a decline through old age to extinction. In the evolution of the stock to which the individual belongs there is a similar law, a rise through progressive stages of evolution to an acme and a decline through retrogressive stages to extinction. These cycles of the ontogeny (the life of the individual) and of the phylogeny (the evolution of the race or stock) can be illustrated by two diagrams of lines arising from a point, diverging to represent the progressive stages and converging to represent the retrogressive. The divergences and subsequent convergences are not simply physiological analogies, as heretofore supposed, but they occur in obvious relations of structures and forms which indicate that one law governs the development of the individual and the evolution of the stock to which that individual belongs.

The various characteristics of an organism develop through youth to the adult and end in the convergences of old age, which is termed the gerontic stage. Species, genera, or genetic stocks of any kind likewise progress from their origin and diverge to an acme, finally converging in the phylogerontic period (the gerontic period of the phylum). This last word is used because it conveys an accurate meaning for which there is no exact equivalent in the English

* This term enables one to consider the future woman who has acquired manly habits and character as tending to become mannish without being necessarily a degenerate being either physically or mentally. In point of fact she may be virified and yet be, according to the standards of advanced women of to-day, superior in both respects, so far as bodily and mental vigour are concerned to the women of the present time.

language, and please observe the use of the word "degeneration" is thus avoided.

The structural changes in the gerontic stage of the individual are repeated with sufficient accuracy in the adult, and often even in the younger stages of types that occur in the decline of the evolution of a phylum, so that one is forced to consider seriously whether they may not have been inherited from types that occur at the acme of the same group. The fact that these changes occur first in the individual during the gerontic stage does not necessarily imply that they first make their appearance after the reproductive period. No gerontic limit is known to the reproductive time in the lower animals, and it may well be that the continual recurrence of gerontic stages in individuals during the epacme of groups may lead to their finally becoming fixed tendencies of the stock or hereditary in the phylum, and thus established as one of the factors that occasion the retrogression or decline of groups. The decline may also be considered as occasioned by changes in the surroundings from favourable, as they must have been during the progression up to acmatic time, to unfavourable during the succeeding declining period in evolution. Still a third supposition is also possible, viz., that the type, like the individual, has only a limited store of vitality, and that both must progress and retrogress, complete a cycle and finally die out, in obedience to the same law.

All of these views can be well supported, but, whatever may be the true explanation, it is obvious that there are plenty of declining types, which, in their full-grown and even in their adolescent stages, correlate in characters and structures with the characters and structures that one first finds in the transient old age or gerontic stages of acmatic forms of the same type. These can, therefore, be truthfully and accurately described as phylogerontic or old in the phylum.

The position of man is at the extreme end of a series of converging lines in his own stock. This is also indicated by his structure and development which is phylogerontic, and it is therefore of the highest importance for him to avoid all movements tending to the increase of his natural and possibly inherent tendencies towards retrogression. The approximation of the sexes in habits of body or mind is therefore to be avoided, as possibly leading to convergence of the progressive characters non-existing between the sexes and the inauguration of retrogressive evolution.

It is hoped that no pretence of being able to solve problems requiring such vast knowledge and many-sided considerations will be attributed to this article, which has been intended simply to call attention to the scientific side of the question. It seems obvious that the time has come when thoughtful men and women should be

warned, if this be possible, that their organisations are not of such a kind that they can rely upon continuous and certain progress. The laws of evolution point distinctly to a future in which retrogression and extinction is perhaps certain; but man's past history and the same laws also hold out hopes for the maintenance of progress through an indefinite time, if he is capable of controlling his own destiny through the right use of experience and of the wonderful control over nature that his capacities have enabled him to attain.

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II

Primeval Refuse Heaps at Hastings

(*Concluded from p.* 44)

THE most remarkable of all the flint implements found in the Hastings Kitchen Middens—or we may perhaps even say anywhere else—is a group of highly specialised diminutive forms totally unlike anything outside their own class. They are usually exceedingly small, very rarely exceeding an inch and a half in length, and sometimes are not one-sixth that size. They are characterised by the peculiarity of their shape and outline, and the method by which the flint has been worked. So persistent are the quaint and curious types, and so unique the working of the flint, that these delicate little implements have been recognised in Egypt, Arabia, Spain, the Valley of the Meuse, and in England by four different field workers. Around Sevenoaks I have found several settlements, and in one case a barrow of these people, in which, probably, the chief was cremated, with implements. Experiments lead me to the belief that this peculiar work, in which the delicate flakes average sometimes only one-thirtieth of an inch in length, was performed by a slot in a piece of bone similar to a saw-setter, as with a tool of this sort I can reproduce this work with its characteristic rectilinear outline. More recently I have noticed a few spheroidal flints, with the edges finely contused. I find that by using these upon a flake lying upon a banker I can lever off small flakes, giving rise to a kind of working very similar to that found on the Midden flints. Amongst these queer little forms are crescents, such as Nos. 8, 85, 10, 11, 12, 8, 4, and 81, which were probably employed for fishing, by a method of suspension that has come down to us, as shown in Plate VI.; also oblique (Nos. $4\frac{5}{1}$ and $\frac{5}{2}$) and incurved pointed tools (Nos. 85, 87, 88), probably used for tattooing and other rites; others are drills; while the use of others, such as those with trapezoidal outline (No. 40, Plate VI.), is past conjecture. Many are simply sharp points, and were doubtless used for fish hooks, being bound upon a crutch twig, in the manner suggested in Plate VI. It is the extreme dissimilarity of these little things from everything else that makes us feel justified in recognising them as the work of one and the same people wherever they are found. They are not scattered indiscriminately all over the surface like the ordinary neoliths, but are confined to settlements, which

are sometimes thirty acres in extent, but more frequently are not more than a hundred yards square.

THE WORKED BONES

One or two of the fragments of bone showed signs of carving. One was a well-made stiletto; another a portion of a needle. A third specimen was probably a potter's tool, as by its use the marks seen round the rim of the pots could have been readily made. The most interesting circumstance connected with the bones was, that in two cases the flint wedges were found *in situ* in the bones, as they were used for splitting them. One of these is shown in Plate VI., left lower figure. The whole of the marrow bones were thus split up for marrow, and the skulls for the brains; and even bones which contain no marrow were often similarly reduced, possibly for either boiling to extract grease or for use in making bone tools. Several other flint wedges similar to the above illustration were also found; and numerous bones showed deep cuts connected with the death of the animals, or those that were made in cutting up the trophy of the chase.

THE POTTERY

The pottery of the refuse heaps is of special interest, as it represents probably the oldest domestic utensils with which we are acquainted. Canon Greenwell has called attention to the fact that most of our Neolithic pottery is funereal or associated with burials: it is always of well-known special types, and none of these were found at Hastings. Some of the pottery here was made from a black, coarse, gritty, carbonaceous clay fairly well baked; some was better burnt and quite red. The majority of the vessels are of one of these kinds. There was a much coarser kind of a deep red colour, apparently composed of coarsely pounded flint, quartz, and clay-iron-stone; from this large utensils were made, and these were often $\frac{3}{4}$ of an inch thick. The vessels were for the most part of two types—the cauldron and the dish; they were all hand-made, none showing a sign of the use of the wheel. The cauldrons were very like the modern tar-kettle, with a flat bottom and no feet, the reflected rim-flange reaching out nearly as far as the widest part of the vessel. Several of these which I have restored give the following measurements:—Height, 9 cm.; widest part of rim, 16 cm.; widest part of body, 17 cm.; bottom slightly convex outwards, 13 cm. Another gives in the same directions 12, 20, 22, and 16 cm. respectively. A flat dish gave height, 3·5 cm.; width of rim, 23 cm.; width of flat bottom, 18 cm. Two fragments of rims showed decoration upon their upper edges. The first consisted of

circular hollows, such as could have been made by the flat round-pointed bone tool, about 11 cm. long, found in the Middens; and the other was a crescent and line marking, such as could have been made by a plano-convex tool with a straight edge. Usually the upper edges of the rims were rounded; in the flat vessels they were not always reflected outwards; and now and then an attempt was made to thicken the top edge into a bead, although the thumb only allowed of very poor success.

THE ANIMAL REMAINS

We next come to the animal remains found in the Middens, which, for many reasons, are extremely interesting. In practically all cases the marrow bones were split for the contained grease; they indicate an unaccountable number of young animals. Many of the bones are also minus their spongy ends or have lost their epiphyses, and some show the marks of teeth. The following are some extracts from my notes upon the species represented :—

Bos longifrons (Celtic shorthorn).—Large limb bones were very rare, and those discovered were all split for the marrow. Most of the bones are young without epiphyses, and indicate small animals; two or three bones and fragments, however, are large and robust enough for *B. primigenius*. The toe bones are all small. The horns are small, short, and slightly curved, the longest measuring eight inches along the outside and seven inches girth; most of the horns must have measured about five inches along the outside curve. In eight cases the ends have been gnawed away. Vertebræ and all irregular bones were very numerous. Jaws were always broken into fragments, none carrying more than four teeth. Loose teeth were fairly numerous, some of which were very much worn.

Sus scrofa (pig).—Parts of all bones were present, and all marrow bones split. Nearly half have lost their articulating surfaces, and only part of them show teeth marks. One bone shows the marks of more spatulate teeth, which may have been human. All the bones are young, few with epiphyses anchylosed. Two or three of the latter were found not to be gnawed. One radius is exceptionally stout; otherwise the bones in general are quite small, many being not more than one-third grown. Pieces of head are numerous; some of the jaws appear rather heavy, and the longest canine measures five inches in length. Pigs' bones were often burnt.

Equus caballus (horse).—There were about twenty bones of horses, chiefly leg and toe bones, one piece of jaw and three odd teeth, all pointing to small or very small animals: they appear

to have been mere ponies. The limb bones are split for marrow, and two pieces are burnt, though none show traces of gnawing.

Ovis aries (sheep).—All the bones of the sheep were found, and, with two or three exceptions, they point to very small animals. They were exceedingly numerous, about as much so as either pig or ox. All the humeri are broken off short; all the radii are split, as are also some of the metacarpals and metatarsals. The bones of this genus are extremely perplexing, as they differ both in detail and proportions from any of the modern sheep with which I have been able to compare them: nearly all of them belong to a small long-legged variety, sometimes even approaching a small deer. One or two bones point to an animal just as much the other way, being altogether stouter than anything I am able to find.

Capra hircus (goat).—There are a few bones and a fragment of a skull with horn core, which Mr E. T. Newton has identified as goat.

Capreolus caprea (roebuck).—About the same number has been referred to roe deer.

Canis familiaris (dog).—Two tibiae represent a dog of very large proportions, almost stout enough for wolf; and some half dozen other bones point to one of full medium size.

Canis lupus (wolf).—One or two bones have been assigned to the wolf.

Felis catus (cat).—There are some half dozen bones belonging to this species which are of large size, and one tibia has lost its soft end, although it shows no teeth marks.

Canis vulpes (fox).—Several bones unquestionably belong to the fox.

Lepus timidus and *L. cuniculus* (hare and rabbit).—Both of these species are represented by few bones. The former was not very large.

Meles taxus (badger).—This species is represented by an ulna; it agrees well with a fine specimen I have from the Thames Pleistocene brick earth, although perhaps hardly so robust.

Birds.—When we come to the birds, I regret to say that our public museums are still so deficient in skeletons for comparison that the determinations are not all quite so satisfactory as could be wished. A larger series for comparison may add several species to the list or perhaps otherwise alter it. Of course there is always the difficulty of being able to say how much variation from the present examples one ought to allow, and this can only be decided more correctly when we have much more modern material in our museums. Mr Newton has identified the following:—Black and red grouse, a species of duck, guillemot and carrion crow.

Fishes.—These include cod in very large quantities, gurnard, mackerel, whiting, *Cottus*, turbot, plaice, and thornback (*Raja*).

The Batrachia are represented by the frog or toad.

Mollusca.—These offer several points of interest. The first to claim attention is a number of very large *Helix aspersa*, which are represented both by whole and broken shells. These were found under about three feet of midden material, and I have no doubt they were eaten by man. *Littorina littorea*, in point of numbers, stands first, and the shells are also of very large size. The limpet (*Patella vulgata*) occurs next in quantity, and is represented by two or three varieties. *Cardium echinatum* is fairly represented, but *C. edule* was not met with. The whelk (*Buccinum undatum*) is plentiful, but *Trophon* was always absent. *Purpura lapillus* is represented by a score or more shells, but whether eaten or employed for their purple juice it would be difficult to say. One piece of bone recovered was of a purple colour, suggestive of having been dyed, although it is highly improbable that the stain would have lasted so long. Most of the oysters (*Ostrea edulis*) are of medium size, suggestive of shallow water; but here and there some were very large, and may have spent the greater part of their time in deep waters. The mussel (*Mytilus edulis*) often occurred in large masses, although the shells were always badly preserved. *Natica*, *Pholas* and *Mactra* are represented by a single specimen each.

CONCLUSION

With this amount of material we are able to restore a fairly satisfactory picture of the men who left the Refuse Heaps at the mouth of the Hastings caves. It is certain that they lived largely upon fish, both those which could be obtained between tide marks and those which would require the use of boats of some sort and the employment of the hook and line; although the spear in the hands of dexterous people, perched upon the rock masses which strew this coast, might have been the favourite instrument. We have no evidence that they knew anything about the use of metal; but they were exceptionally skilful fabricators of flints, which they worked in a manner essentially their own, of such diminutive sizes as to suggest that the delicate little instruments were largely employed for fish hooks. The absence of battle axes and all other heavy tools would point to their not being much employed in wars or agricultural pursuits. No cereals of any kind were found, and no querns or large mealers; although leaves and twigs were often preserved. They knew the use of fire, which they lit upon hearths, and kept them going until they had baked the underlying ground for seven or eight inches. They also employed cooking stones, or "pot boilers" as they are sometimes called. Their pottery, although coarse, was fairly well modelled considering there is no sign of the

knowledge of the wheel. It was also fairly well baked, and would stand the fire, as is shown by the deposit of soot upon some of the fragments. They appear to have known nothing about the art of polishing flint or the barbing of arrow heads. In none of the settlements where the characteristic implements have been found, has anything been obtained to conflict with the evidence of the Middens in any way. The barrow at Sevenoaks, which contained similar relics, it is true, was nearly round, pointing to the close of the Neolithic period; but further research induces me to consider that these people might nevertheless have preceded the days of the barbed arrow and the polished axe, and this conclusion is strengthened by the geological evidence of Dr Colley March in Lancashire. It is probable that the ox, the 'sheep,' and the pig were confined in enclosures, where they lived in a semi-domesticated state. Man also seems to have domesticated the dog, which possibly assisted in keeping the cattle, although the canine bones sometimes look as if they had been gnawed. It is certain from the large quantities of bones present that animal food was indulged in whenever obtainable, perhaps even more so than was the case with the Baltic Midden men. But the motley group of animals represented at Hastings show the men there to have been anything but epicures, as they appear to have eaten anything upon which they could lay their hands.

The occurrence of these implements thirty or forty miles inland in a number of places, suggests their being the work of a Nomadic people, but whether or not the trans-European localities can be taken to indicate the line of original migration, further researches will alone decide. This much is however proved, that the Midden men will henceforth have to be added to the pre-historic races of Britain.

W. J. Lewis Abbott.

III

Bees and the Development of Flowers

IN the "Origin of Species," Darwin expressed the view that we owe the gay colours and varied forms of our flowers to the selective action of insects. "We may safely conclude," he writes, "that if insects had never existed on the face of the earth, the vegetation would not have been decked with beautiful flowers, but would have produced only such poor flowers as are now borne by our firs, oaks, nut, and ash trees, by the grasses, by spinach, docks, and nettles."

This theory of the selective action of insects on flowers has been elaborated in great detail by Hermann Müller in Germany, and by Sir John Lubbock and Mr Grant Allen in this country; and almost every writer on Natural Selection has accepted this view as a part of the Darwinian scheme of evolution. In this case, as in many others, more recent observers, assuming that the foundations are secure, have spent their time in elaborating structural details in the hypothetical edifice. But when we lay the ingenious conception along the straight rule of facts in nature, the measures do not correspond. In other words, the foundation, the habits of insects with regard to flowers, does not support the hypothetical superstructure.

Professor Henslow, again, has proposed an amendment, in which, although selection by insects is still the motive power, the *modus operandi* is different.

Stated briefly the Darwinian theory is as follows:—

Insects come to flowers for honey and pollen, and in so doing do not visit all indiscriminately, but select those which take their fancy, or suit them best. If they are seeking honey they will choose those flowers which afford the most, or in which it is most easily obtained; if they have a special liking for any colour, say blue, they will pick out the bluest flowers; if any special shape of flower affords them greater convenience for alighting, they will visit these rather than others. Now in any species of flower all these things—amount and position of honey, colour, and shape—vary in different individuals. If, then, insects possessed the requisite discrimination, we might suppose them selecting, generation after generation, those flowers in which these desirable points were most highly developed. The flowers thus visited would obtain the

benefits of cross-fertilisation, and their descendants would therefore be more numerous and vigorous than of those not visited. This more vigorous progeny of the insect-visited and cross-fertilised flowers would gradually live down the less vigorous offspring of the unvisited flowers. Hence any particular character perseveringly selected by insects for many generations would come to predominate, be gradually perfected, and finally form a new specific type.

Such is a brief outline of the theory which has captivated the minds, not only of men of science, but also of the public, and which has been accepted by almost every evolutionist as the explanation of the form and colour of flowers. Professor Henslow's amendment, while still depending on selection and the benefits of cross-fertilisation, attributes the alteration in the shape and colour of the flower to the direct stimulus of the insect's action. Thus an insect hanging to the lower petal of a flower elongates the same by its weight, and the lengthened petal is transmitted by heredity; the irritation caused by its feet in walking along the flower causes the appearance of colouring matter, and the colour is likewise transmitted; as it probes for honey it causes a flow of sweet sap to that part, and this also becomes hereditary. This view is quite too Lamarckian for England or Germany, whatever may be its fate in America.

The weight of authority supporting the insect selection theory, and its wide acceptance in scientific circles, renders it perhaps a little rash to criticise it adversely; yet a series of observations on the habits of bees with regard to flowers extending over many years, has forced me to the conclusion that it has no sufficient foundation in fact. Details of some of these observations have been given elsewhere, and I shall here state only the general results. Bees have been chosen because, of all insects, these are the easiest and most interesting to watch in their visits to flowers. They are also the most important of insects for the theory, since they are by far the most frequent and regular visitors of flowers. If the bee's action can be shown to be insufficient, no one will support the claims of any other insect. Let us, then, see what the bee really does in the way of selecting special forms and colours of flowers by watching it in the fields and gardens, and consider what effect this can have on the flowers visited.

It has been frequently pointed out that Sir John Lubbock's experiments prove that bees have special tastes for certain colours, and that they prefer red and blue, especially the latter. This preference of the bee for blue is one of the cardinal points of the theory, and has been considered almost sufficient in itself to justify the assumption that blue flowers have been evolved by their selective action. But without wishing in the least to disparage the work of one of our great authorities on insects, I submit that observations of what bees

actually do in the way of visiting flowers is of more importance to the theory than any such experiments; and, as we shall see presently, bees in visiting flowers do not show any marked preference for blue ones.

The analogy between man's selection resulting in artificial breeds, and natural selection resulting in species, was often and strongly insisted on by Darwin; while the action of the insect in evolving a new species of flower specially adapted to its requirements in form and colour, has been compared to that of the gardener in the production by selection of his special varieties. The extreme care required from the gardener, not only in the selection of the requisite variation, but also in its isolation and preservation is well known. If the new variety in the process of its evolution be allowed to cross with the parent stock it is lost. Darwin even went so far as to warn gardeners against allowing crossing between different individuals of the new variety, as such tends to produce reversion. It is a little difficult to understand how the bee, even if it possessed all that nice discrimination of form and colour, and all that constancy required by the theory, could accomplish that which demands such care and patience on the part of the gardener. In order to evolve a race of blue flowers from those normally of another colour, bees would have to select those among the slight natural variations which had a tinge of blue. If they really preferred to gather honey from blue flowers—they would not have merely to prefer blue in the abstract—they would do so, and these bluish flowers would receive the benefits of cross-fertilisation. But the few bluish flowers among the many normal ones would not suffice: the bees, from the necessity of obtaining honey, would be obliged to visit the normally-coloured ones also. Thus the new variety would be blended with the parent type and lost, for pollen would be carried from the one to the other. In order to isolate the bluish variety, the bee would not only have to prefer blue, but also steadily refuse to visit any other colour; and if it did so when the bluish flowers were first appearing it would starve for want of honey. But we have no proof that the bee even possesses the taste. In all my observations of bees I have met with nothing to support the view that they prefer to take their honey out of blue flowers. Some blue flowers they visit frequently, others they visit very seldom. No blue flowers are more frequently visited than others which are yellowish-green, pink, and various other shades. Some uncompromisingly green flowers—as the plane tree and red currant—are frequently visited. As regards colour, then, the bee seems to have neither the taste to select, nor the ability—through the necessity of obtaining sufficient honey—to restrict itself in the manner required. Moreover, the fact that the same species of bee may be seen visiting flowers of the most diverse

shapes, from the simplest to the most complex, does not seem to imply that they have the requisite selective tendency as regards form. This is further illustrated by the fact that bees may at times be seen visiting flowers which have lost their corollas wholly or in part. Thus I have seen them visit petal-less flowers of wild geranium, bramble, and cistus. Darwin relates his observation of the same fact. More recently Professor Plateau of Ghent has removed the corollas of certain flowers, and found that this proceeding made little difference to the insects visiting them. Bees may also be seen to visit abnormally developed, as well as half-faded flowers. In many cases, again, bees instead of using the form of the flower supposed to be specially fitted for their convenience, and the outcome of taste, will bite a hole near the base of the corolla, and get the honey through it. These holes may frequently be seen in heath and the bush vetch.

Again, if our native flowers are the result of the selective action of our native bees, and those which they have specially chosen for countless generations, how is it that bees take so readily to many flowers of very different forms introduced into our gardens from abroad? For such introduced plants are in many cases freely visited by native bees.

In order to evolve and keep distinct new species bees would have to be extremely constant in their visits to flowers: in a single journey from the nest, or until they got rid of all the pollen adhering to their bodies, they would have to visit only a single variety. If they did not do so they would not merely be unable to develop and differentiate new varieties; they would even retard by intercrossing, varieties developing into species by any other means. It is pretty generally believed that the bee is very constant in its visits to flowers, and that when it begins with any particular species it keeps to that until it has obtained its load. So long ago as the time of Aristotle, indeed, the constancy of the bee was noted as a fact in natural history. But while it is true that bees do show a considerable amount of constancy and often visit a large number of flowers of the same species in succession, they are far from possessing that amount of constancy required by the theory. For this they would require to restrict themselves, not merely to a single species, but to one variety of that species. This is obvious, since all species are supposed to have begun as varieties; and it is even more important that they should restrict themselves to one variety than to one species, since such varieties will be more readily crossed by transference of pollen. But it is a well-established fact that bees pass freely from variety to variety of the same species in our gardens. Darwin has observed this, and it is one of the most firmly established results of my own observations. They do not even confine themselves in a single

journey to varieties of the same species. In numerous cases I have seen bees visit two, three, and even four species in the course of a minute or two. The general results of my observations on this point are as follows:—

Hive bees are much more constant than wild bees, yet they pass freely from variety to variety, and not by any means rarely from species to species. As to the latter, take any wild bee, and if you can follow its movements for twenty visits or more, the chances are something like ten to one that it will be seen to change its species of flower. If we suppose that the bee of the past acted as the bee of to-day, then it seems to me that in this habit alone we have a complete refutation of the theory.

Another of the foundations of the theory is the benefit supposed to result from the cross-fertilisation effected by the bee in flying from flower to flower. Darwin's well-known experiments on cross-fertilisation point to the conclusion that the seedlings of cross-fertilised plants are more numerous and vigorous than those of the self-fertilised. Without wishing to throw doubt on the general deductions from these experiments, I may be permitted to point out that certain facts regarding fertilisation in nature render them of doubtful support to the theory. First, there is the fact that certain species of flowers which are habitually self-fertilised are among the most numerous and vigorous of our native plants. Such, for example, are *Polygonum aviculare*, the least visited by insects, and yet the most abundant of its genus: *Veronica hederaefolia*, one of the commonest of the veronicas, yet very seldom visited by insects, as H. Müller points out: while among the geraniums, *G. molle* and *G. pusillum*, which Müller states to be the most frequently self-fertilised, and perhaps the most common of their genus with the exception of *G. robertianum*. Professor Henslow, indeed, has gone so far as to state that "in nature whenever self-fertilisation can be effected more seed is borne than by the forms requiring crossing." Among the orchids again, some species exhibit the most complicated arrangements for avoiding self- and securing cross-fertilisation; others exhibit equal complications for securing the former and avoiding the latter. And if the inference is that the contrivances in the former case were evolved because cross-fertilisation was an advantage, then it follows equally that in the latter case they were evolved because self-fertilisation was an advantage. Darwin, in accordance with his general views on cross-fertilisation, believed that such self-fertilised orchids were dying out, but the increased number of such now known seems to forbid this view, and it is difficult to understand how such self-fertilised orchids can have been evolved from a race specially fitted for cross-fertilisation on the supposition that this latter method is always beneficial.

Those flowers of the original race which were cross-fertilised should have survived rather than those self-fertilised. The passage from perfect adaptation for cross-fertilisation to perfect adaptation to self-fertilisation is a long one, and must have been spread over many generations in each of which the latter was an advantage, if it is to be accounted for on the principles of natural selection. But it has been suggested that the change has been due to the absence of insects and that thus only those plants which were able to fertilise themselves survived. If, however, we suppose that in the ancestral orchid the apparatus for cross-fertilisation was as perfect as in many species at the present day, it would be incapable of self-fertilisation, and therefore die out in the absence of insect visits. Even if it could in a few cases fertilise itself, how could its fewer and weaker progeny compete with the stronger seedlings of nearly related and cross-fertilised species probably occupying the same station? If, however, in the ancestral orchid the arrangement for fertilisation was such that self-fertilisation usually took place in default of insect visits, then no benefit would arise from change of form to perfect adaptation for self- and avoidance of insect-fertilisation. With regard to the benefits resulting from cross-fertilisation generally, Professor Henslow points out that orchids, the most remarkably adapted of all plants for cross-fertilisation by insects, "set the least amount of seed even when fully exposed to insects."

Another fact established by Darwin in relation to cross-fertilisation is that the offspring of the cross is more vigorous when between slight varieties of the same species, or between individuals grown under slightly different conditions. This fact is also adverse to the theory of the development of a species of flower by the selective action of the bee. For among the offspring of the crosses affected by it those will be strongest which occur between varieties, or between plants grown at a distance, and therefore likely to differ slightly from each other. But these are precisely the individuals in which the incipient characters tending to the formation of a new species will be least marked. Hence the action of the bee is rather to retard development; and Darwin himself has remarked that frequent in-crossing tends to give uniformity to species varying slightly as they do in a state of nature.

A brief allusion to Professor Henslow's amendment of the Darwinian insect selection theory will suffice. Apart from the extreme improbability—as shown by recent research—that such acquired characters as the lengthening of the petal of a flower by the weight of an insect stretching it, or the coloration caused by the irritation of an insect's feet, are transmitted, Professor Henslow's theory splits on the same rock as the older one. For, like the

other, it requires a discriminating taste and constancy on the part of the bee. It involves, moreover, the assumption, that while certain simple and regular flowers visited by insects have remained simple, others originally equally regular and simple have had impressed on them all sorts of irregular and complex forms by the same insects visiting them in the same way and for the same purpose. If the direct action of the insect in visiting one simple and regular flower is to elongate one petal and form a hood of another, how has it been possible for it to visit a host of others for countless generations without producing any such effect, or altering the simple regularity of their form? It is not probable, then, that Professor Henslow's amendment will be adopted, at least in these days of scientific doubt as to the transmission of acquired characters.

Other insects, it is generally admitted, are even less discriminating, and more erratic, in their visits to flowers than bees. Hence, if bees cannot be accepted as evolvers of new species of flowers by their selective action, the whole theory of insect selection fails. It remains a fact that no alternative explanation of the origin of the colour, scent, and form of flowers on Darwinian principles has yet been brought forward. In this fact, indeed, we have the only —if insufficient—reason why the theory has been so long retained.

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IV

Polymorphism in the Algae

THE following is a translation of an extract (pp. 171-186) from Professor Klebs' recent work "Die Bedingungen der Fortpflanzung bei einigen Algen und Pilzen," Jena, 1896, reviewed in *Natural Science*, vol. x., p. 128 (Feb. 1897).

The pages in question are written *à propos* of Prof. Klebs' interesting discovery that the well-known alga, *Botrydium granulatum*, is not in reality so polymorphic as the botanical world has believed since the publication in 1877 of Rostafinski and Woronin's researches, but that the forms therein described belong, in reality, to two very distinct algae, *Botrydium granulatum*, Wallroth, and *Protococcus botryoides*, Kützing, the latter being renamed *Protosiphon botryoides* (Kützing) Klebs.

But my immediate object is not so much to call attention to this or any other of the interesting discoveries of which an account is given in Prof. Klebs' important book, as to put into a form easily accessible to everyone interested a most lucid and admirable discussion on a question which, to judge from my own experience, must continually perplex students of algal literature. No one who knows his work can doubt Prof. Klebs' authority to speak on the topic, and it is unfortunate that his luminous remarks, which are perfectly complete in themselves, should remain buried in the middle of a chapter of his bulky volume, where they can only be read by a few specialists. Prof. Klebs and his publisher, Dr Fischer of Jena, have most kindly accorded me permission to publish this translation. A. G. TANSLEY.

Although a number of the lower green algae were described in the first half of this century, it was by Kützing and Nägeli that the foundation of our present knowledge of these forms was laid. Kützing described an enormous number of species which he distributed partly into new genera, partly into those which Nägeli had with admirable judgment already established. Side by side with the tendency to a thorough-going splitting of species, we find in Kützing the belief that lower algae transform themselves into higher forms, even into moss-protonema. Hitherto these polymorphistic ideas of Kützing's have not succeeded in establishing themselves, since they are obviously based on too cursory investiga-

tions. The description of new species and genera of lower algae went quietly forward till Cienkowski published in 1876 his observations on the palmella-condition of the filamentous algae, *Stigeoclonium*, *Ulothrix*, etc. These very reliable observations seemed to prove that lower algae are only developmental stages of the filamentous forms. Cienkowski himself, and other workers also, went so far as to express doubt as to the independence of most unicellular green algae. In order to decide the question, I established from 1879 to 1881 many cultures of these forms. My observations, from which I published a short extract in 1883, showed that the lower algae, treated by the methods then accessible to me, were as much independent organisms and remained as constant as any higher plant. The common, universally distributed organism, *Pleurococcus vulgaris*, for instance, reproduced itself only by vegetative division, and it could not by any method be converted into another alga. Artari (1892) again investigated this question, and answered it in the same sense. Gay also (1891) has proved by means of cultures the independence both of *Pleurococcus* and of other forms. Nevertheless, the old idea of a far-reaching polymorphism among the algae is constantly reappearing.

Since Hansgirg in 1885 came to the conclusion that all possible algae are forms of a single species, and thus showed himself as uncritical as Kützing before him (*cf.* my criticism, *Botanische Zeitung*, 1886), Chodat, and especially Borzi, have quite recently announced the genetic connection of many algae which were hitherto considered independent. Both workers have tried to give greater weight to their opinions by means of evidence obtained from culture experiments. To what an extent Borzi is dominated by the idea of polymorphism is shown in his most recent work (1895) by the treatment of the life cycle of "Protoderma viride," to which he assigns species of the following genera: *Protococcus*, *Botryococcus*, *Chlorococcus*, *Limnodictyon*, *Physodictyon*, *Palmella*, *Tetraspora*, *Nephrocytium*, *Trochiscia*, *Oocystis*, *Scenedesmus*, *Raphidium*. The connection of all these forms Borzi thinks he has proved by means of cultures. According to the view of this worker, the various developmental states have "stadii anamorfici"; thus, for instance, the *Raphidium*- and *Scenedesmus*-forms have the power under certain circumstances of remaining and multiplying as such for years, and then when opportunity offers they again turn into the higher forms.

Chodat does not go nearly so far as Borzi in his belief in polymorphism, and he expresses himself less clearly and distinctly. He contents himself with believing (1893-4-5) that such an alga as for instance *Raphidium*, is very variable, so that it may take on the form of a *Scenedesmus*, a *Protococcus*, a *Characium*, a *Dactylococcus*, or a *Sciadium*. The *Scenedesmus* behaves under certain circum-

stances as a *Dactylococcus*, and the latter as a *Scenedesmus*. But in spite of all his belief in the existence of transitions between the various forms of lower algae, in spite of the fluctuation of all their characters and of the melting away of all limits, Chodat still holds to a certain independence in the various types; only it does not appear from anything he says whether the deviations from these types are due to the definite effects of external conditions or whether they belong to constant varieties or races. Neither has Chodat always drawn accurate inferences. If his observation is correct, that the already-mentioned *Pleurococcus vulgaris* can grow out into a *Stigeoclonium*, it must be assigned to the branched filamentous type of algae. But Chodat says, "I do not think that *Pleurococcus* is a state of a higher alga. I think that it must be considered as a type degenerated through the influence of its habitat, and which in water and under favourable conditions can tend towards its primitive state." Thus *Pleurococcus* is to be considered a degeneration-form of a *Stigeoclonium*, although it behaves as an independent simple alga. If one takes the observations of Chodat and Borzi together, so far as they relate to the same form, for instance *Raphidium polymorphum* (or *braunii*), one obtains a picture of a species which for excentricity certainly leaves nothing to be desired, and which is unique in the organic world. *Raphidium*, according to Borzi, belongs to the cycle of forms of various higher algae (*Prasiola*, *Ulothrix*, etc.); it is produced in this way—two zoospores, in consequence of their escape from the sporangium taking place abnormally, grow together by their hinder ends, and this pair then turns into a *Raphidium* (Borzi, 1895, p. 231, "My cultures exclude all doubt as to this fact"). If it had not been such a well-known and eminent algologist as Borzi who put forward these opinions they would not have been worth the trouble of wasting a word upon, but under the circumstances they must be taken into account. In any case it is clear from what has been said, that unlimited confusion prevails in the classification of the lower algae, and that the most contradictory views are held even about the simplest and commonest organisms such as *Pleurococcus*, *Raphidium*, etc.

We cannot decide on theoretical grounds whether a form is independent or genetically connected with another. It has in fact happened in the history of the subjects that forms which at one time were considered independent have been certainly proved to be developmental states of other species. It is conceivable that out of the enormous number of described species of algae many others will meet with the same fate. The only possible way to arrive at clearness and knowledge is to use a scientific method which will stand the test of criticism.

It is remarkable that so little has been learnt from the history

of science. In the history of botany the same struggle about polymorphism has taken place twice, first in the case of the fungi and then in that of the bacteria. On both occasions as it gradually became recognised that the pure culture of the organisms in question is the necessary starting point of every research, the fruitless theoretical discussions were replaced by work on really scientific lines. Likewise in the present case; for the solution of the problems with which they were concerned Chodat and Borzi ought to have started with pure cultures; but this is just what they failed to do. The method of pure cultivation has hitherto played no part in algology; our knowledge has been obtained by the method of direct observation, which has been employed in a most thorough way by such investigators as Thuret, Cohn, Pringsheim, De Bary, and others. The fact is that the distinctive characters of many algae are quite sufficient to allow of their recognition among other organisms, and to enable their development to be followed by continuous direct observation; and the artificial cultivation of many of these algae is beset with great difficulties. There are also many of the lower algae among which no confusion arises in impure cultures. Forms such as *Hydrodictyon*, for instance, allow of their entire development being observed in the presence of other larger or smaller forms. But the matter is quite otherwise in all those algae which possess but few external readily recognisable characters, and among which at the same time there is such a multiplicity of closely allied species that all possible so-called transitional forms exist. This is the case, for instance, in the subaerial *Ulothrix*-like organisms, and also among the lower green algae such as the numerous species of *Pleurococcus*, *Protococcus*, *Palmella*, etc., which are extremely easy to confound with one another. Furthermore, the higher algae possess developmental stages which to outward appearance are exactly like certain lower forms; and the false conclusion that therefore all lower algae are developmental forms of higher algae is often enough drawn. Swarming gametes of *Chlamydomonas* cannot be distinguished from gametes of *Ulothrix;* but it does not follow that *Chlamydomonas* belongs to *Ulothrix*. Similarly filamentous algae form *Protococcus*-like stages; but again it does not follow that all species of *Protococcus* belong to filamentous algae. Simple similarity in appearance or the apparent identity of two forms decides nothing, and anyone who relies upon it runs the risk of falling into the grossest error. Even two such distinguished investigators as Rostafinski and Woronin were baffled in their observations on *Botrydium* simply because the developmental stages of the real *Botrydium* and of *Protosiphon* have a striking external resemblance.

The question now presents itself, how must we proceed in order

to solve the problem of the independence or genetic connexion of two or more algae with the greatest possible certainty? In my view such an investigation demands attention to three important points:—

(1) The pure cultivation of the organisms in question

Just as a pure culture is obviously essential for any research into the history of development of a fungus or of a bacterium, a similar culture is the necessary starting point in the investigation of the life-history of a lower alga. In general, the algae grow much more slowly than the fungi and bacteria; cultures, therefore, have to be maintained for a longer period, and the chance of the accidental introduction of foreign forms into an originally pure culture must not be neglected. Minute cells or spores of Protococcoideae, etc., are present in the dust of the air. It is only necessary to leave a sterilised solution of nutritive salts, not very well protected, in the light, in order to convince oneself that algae get into it with the dust. It is clear from the works of Chodat and Borzi, that these workers had only impure cultures at their disposal, since, on the one hand, they used material taken direct from its natural habitat, and containing numerous species of algae, and on the other, they paid no attention to the sources of error arising from the exposure of their cultures to dust.

(2) Direct observation

In the case of the lower algae it is always necessary to observe directly under the microscope, the course of development or the transformation of one form of cell into another. In default of a pure culture, this method may, under certain circumstances, do instead; but it should be used in any case, even if the culture is to all appearance pure. A combination of the two methods leads to very certain results. Chodat and Borzi have employed them far too little. For instance, Borzi ought to have isolated the double zoospores of *Prasiola*, etc., and then uninterruptedly observed their subsequent fate, in order to convince himself that they actually turned into *Raphidium*. And similarly it would be necessary to observe directly the development of the filamentous alga, whether *Prasiola* or *Protoderma*, from *Raphidium*, a thing which it appears Borzi never really saw. The same criticism holds in regard to Chodat's statement that *Pleurococcus vulgaris* changes into *Stigeoclonium*. The immediate transformation of an undoubted *Pleurococcus* cell into a *Stigeoclonium* has not been seen, any more than a transformation of the latter into *Pleurococcus*.

(3) An accurate knowledge of the conditions under which the individual developmental stages occur, or the transformation of one form into another obtains

This point has received as yet scarcely any attention in algae or other organisms, *e.g.*, fungi, and such knowledge has never been recognised as necessary, since it has not hitherto been believed that it was possible to determine these conditions. In works which deal with polymorphism, from Kützing to Borzi, great significance has, it is true, been attributed to external conditions in the transformation of forms, but only in quite a general, undefined and vague way. Never in any case has a given developmental form been clearly recognised and demonstrated as the necessary consequence of definite external conditions; such forms have mostly been observed merely by chance. In his work on *Eremosphaera*, Chodat describes, besides the well-known typical cells, certain dwarf forms with somewhat different structure, he describes *Palmella-Gloeocystis*-stages, he also brings a *Chlamydomonas*-form into connexion with these; all of which are developmental forms or (it may be) independent species found accidentally in the same culture of *Eremosphaera*. We never get a hint of an explanation how such various states of the same alga can appear in the same culture.

But since my observations have shown that external conditions actually decide the appearance of the reproductive stages of many algae, it has become necessary in all similar work to attempt at least to discover the appropriate conditions of the appearance of each developmental form.

The next goal to be attained is such an exact knowledge of the conditions that we can elicit a given developmental form at will. Such investigations as these naturally demand much time and trouble; and even so in the case of many organisms they do not lead to the desired result. Thus, in certain species, in spite of the firm conviction that external conditions must be of great significance, these conditions are not yet sufficiently clearly understood, as for instance in the case of *Ulothrix zonata*, *Hormidium nitens*, etc. Thus there remains a gap in our knowledge, which, later on, with the aid of better methods, will be filled up. On the other hand, there is the alternative that a given developmental form is produced as a result of the operation of inner causes which we are not able to elucidate; in that case we shall find by experience that it will appear quite regularly and can always be observed at the appropriate stage in the life-history of the species. But in all the lower algae—and these are the forms I am specially considering here—my whole experience leads necessarily to the conviction that external conditions determine the appearance of each developmental

form; and hence in all work on such algae this line of investigation demands the greatest attention.

If in the future the lower algae are investigated on the lines I have indicated, it will be possible for us to emerge from the confusion prevailing at present, and to bring the study of these organisms on to a higher plane. Such investigations will, according to my view, be of very great value in advancing the systematic knowledge of species, not only because they will enable the cycle of forms belonging to a given species to be completely determined, but also because in the diagnosis of the species they will enable new characters to be recognised. The way in which the various stages in the life-history of a lower organism react to external conditions, especially the way in which its reproduction depends upon the external world, furnish specific characters as important as the morphological ones. And these physiological characters become so much the more valuable in proportion as the external characters become less conspicuous. In the bacteria we have already been compelled to take such characters into account; and the time is not far distant when it will be self-evident that in the diagnosis of a new alga, there must be placed alongside of the accurate description of its structure and the history of its development, a clear account of its behaviour in relation to the external world. To-day the mere determination and the giving of a name to a species is far too generally the sole aim in systematic botany, and it is here, among these lower organisms, that the proper goal of the systematic knowledge of plants may be soonest reached—to present a complete picture of all the peculiarities of each several organism.

The whole of my more recent experiments with algae confirm my earlier experience, and correspond with the results of the investigation of bacteria and fungi—they show, namely, that within the time available for experiment, the hereditary characters of an organism are not markedly altered by external conditions. The variations in size, form, cell-structure, and reaction to external influences, oscillate within definite limits—limits which up to the present we have not been able to pass. The constancy of the species meets us with striking clearness in all cultivations and experiments under existing conditions; it remains for further experiments, carried on for longer periods, and with the aid of better methods, to decide whether these limits cannot be broken through. The important observations on certain bacteria, in which it was found that hereditary characters such as virulence and pigment-production, could be suppressed for a long time, point in this direction. But anything like such a result has not hitherto been obtained among the algae, although it is possible that it may be obtained in the future.

In spite of the actual constancy of specific character among the

algae, the difficulty of arranging the species into genera and families is extraordinarily great, since there has been an enormous multiplicity of species production. There exist, between the species typical of the various genera, numerous other forms, varieties, etc., each of which is a perfectly constant type, but which confuse the limits between genera and families. Very soon the dictum which I laid down in connexion with my systematic working up of the Flagellata in 1892, will apply equally well to the algae, namely, that the more we take into consideration the multitude of forms, the more difficult to construct and the more artificial our system becomes. The contradiction between the constancy of the single form, whether we call it species or variety, and the variability of all characters within the limits of an extended circle of forms, be it genus or family, has not yet been explained; Darwinian teaching has brought clearly to light the existence of this contradiction, but it has not yet discovered how to resolve it.

GEORG KLEBS.

V

On the Scientific Measure of Variability

TO review the reviewer is always a profitless task, and yet I am tempted to repeat what must be more or less of a failure. In this case, however, the reviewer happens to be a man whose opinion deservedly carries weight, and many readers may consider that he must have fairly epitomised the statements made in my paper on "Variation in Man and Woman." This does not seem to me to be the case; and, in justice to myself, I wish to distinctly repudiate one or two opinions Professor Weldon fastens upon me (*Natural Science*, vol. xi., pp. 50-54).

In the first place, Professor Weldon states that the object of my paper "is to support the contention that women are, on the whole, more variable than men." I wish to entirely disclaim any such object. The paper was written with the purely scientific aim of comparing the variation of man and woman, and was due to the fact that a study of numerous writers on the subject had led me to believe that there was as yet no evidence to show greater variation in one sex than the other; that most of the reasoning on the subject was invalid and nearly all partizan. I may safely say that the two friends who undertook with me the lengthy arithmetic involved had no "contention" and no bias. We simply thought that no evidence of a satisfactory kind was forthcoming, in the case of man, for Darwin's law of the greater variability of the male; and we determined, so far as was possible, to undertake a thorough investigation of the question. And what is the general conclusion reached? That the female is more variable than the male—which is the impression any reader must form from Professor Weldon's review? Not at all. In the summary I distinctly state that, in the material considered, there is no evidence of greater male variability, but rather of a slightly greater female variability. In the body of the paper it is stated that the less civilised races have nearly equal variability for the two sexes, while, in the more highly civilised, woman—probably owing to the lessening of her struggle for existence as compared with man—has apparently greater variability. I conclude:—"I would ask the reader to note that I do not proclaim the equal variability of the sexes, but merely assert that the present results show that the greater variability often claimed for man remains as

yet a quite unproven principle." The "contention" of the paper is that there is no proof forthcoming of man's greater variability. Whether either sex is the more variable is left for the future to settle in the following words:—

"When more material is available, and finer methods are applied, then perhaps it will be possible to detect a more noteworthy preponderance of variability in the one or other sex." And, again, in referring to the slight preponderance of variability observed in woman:—"I strongly suspect that this preponderating variability of women is mainly due to a relatively less severe struggle for existence." These are not the words of one whose "object is to support the contention that women are, on the whole, more variable than men." They seem to me the words of one who wishes to reach a scientific conclusion without any party or sex bias.

In the next place, Professor Weldon objects to my use of the co-efficient of variation. He apparently wishes to assert that absolute variation is the real test of most things. I am somewhat surprised to see him advocating this test. It is not so many months since an American critic pointed out how fatally this measurement of variation affected the conclusions of a certain paper of Professor Weldon's on selective mortality in crabs. I have not seen any answer to that criticism, and I very much doubt if one can be found. Some years ago I pointed out to him that the same measurement of variability led to absurd results in the case of the selective mortality of men.

But even here Professor Weldon puts in my mouth opinions I have never expressed. He writes:—"The violent assertion that there is only one 'scientific' measure of variability is therefore to be regretted." Now, so far from asserting the validity of only one measure of variability, I carefully state in paragraph (*c*) of my conclusions:—

"There is more than one method of quantitatively measuring variability, but the measure which is really significant for progressive evolution has not hitherto been determined."

On p. 343 I write, "We may stay to ask whether the statistics of skull capacity do not in themselves give us any information with regard to the superiority of either standard deviation or the co-efficient of variation as a test of that variability which is valuable for progressive evolution," and on p. 345 I conclude that the results do not enable us to say offhand that absolute or percentage variation is a better measure of the variability which is a source of progressive evolution. These are hardly the words of one who has made a "violent assertion that there is only one measure of variability."

What is it then that I have asserted? Simply this, that if it be necessary to compare the variability of the same organ in two sexes which have on the average different sizes, it is absurd to use absolute variations. This conclusion is nothing new; it has long been familiar to craniologists and anthropologists. They have, for instance, compared brain-weight relative to body-weight or to stature. I contend that the proper measure is the percentage variation on the mean. My words are, "I hold that the only useful sense in which we can study relative variability is by endeavouring to answer the problem. Is one sex closer to its mean, more conservative to its type than the other? and that the only scientific answer to this lies in the magnitudes of the percentage variations of the two sexes for corresponding organs." It will be seen at once that this is not, as Professor Weldon appears to misinterpret it, an assertion of a single scientific measure of variability but a statement of opinion as to the only useful way in which we can compare in the two sexes the relative variability in the same organ. Professor Weldon, indeed, seems to confuse two things, the scientific measure of variability and the effectiveness of this variability for different organs in the struggle for existence. Because the variability of one organ is said to be twice that of another organ, it does not follow that the functional importance is doubled. The scientific measure of variability is one thing, the effectiveness of this amount of variability in the struggle for existence is another and different thing. But even here I am prepared to assert, although I have not done so in my paper, that the co-efficient of variation, without being proportional to the "effectiveness," is far more reasonable as a measure of effectiveness, when we are dealing with the same organ in different sexes, or in individuals of the same sex at different ages, than absolute variation. It seems to me that the non-regard of this point has led to the nugatory character —not of the splendid system of measurements on crabs made by Professor Weldon—but of several of the conclusions he has endeavoured to base upon those measurements. I cannot get over the fact that the variation of an inch in the leg of a pony is not the same thing as a variation of an inch in the leg of a horse. Out of the 155 cases dealt with in my paper, woman is in 62 or 63, I think, absolutely more variable than man, and man absolutely more variable in some 85; in the remainder the sexes are sensibly equal. But since woman is smaller than man in the weight and size of nearly all organs, absolute variability can only be adopted with the same justification as we should say that an inch is the same variation in the leg of a pony or a horse, or a cubic centimeter the same variation in the capacity of the brain of a man or a new-born infant.

If Professor Weldon asserts that taking the co-efficient of variation

as a standard, then the same amount of variation in man and woman has more effectiveness in one sex than the other, I must reply, no one has yet investigated this point; my own conclusions on skull measurements, so far as they have yet gone, seem to show that the co-efficient is at least a rough measurement of effectiveness. But it must be clear that until we have investigated the relation of effectiveness to some clear measure of variation, Darwin's law of the greater variability of the male is entirely unproven. Whether we put effectiveness as a function of mean and of standard deviation, or as a function of mean and the ratio of standard deviation to mean, is not, at first sight, a matter of great importance; it is to be settled rather by what the algebraist considers a convenient shape for his formulae. It is the biologist who has to determine the form of the function. It probably varies widely from species to species and organ to organ, but it may reasonably be supposed to vary only continuously and gradually with age and sex. If the selective death-rate of any species, however, be a function only of the mean and standard-deviation of any particular organ, then the theory of dimensions shows us at once that the death-rate cannot be a function solely of absolute variation, but must be a function of the ratio of absolute variation to the mean, *i.e.*, of the co-efficient of variation.

Lastly, if Professor Weldon thinks I have reviewed my biological critic harshly, I would remark that I submitted my paper a year ago in proof to a valued biological friend, I still have in a familiar hand-writing "no suggestions to make." That Professor Weldon should find in my paper a "violent assertion" to be regretted, confirms my view that modern biology is a house divided against itself.

KARL PEARSON.

VI

Initiation Rites of the Arunta Tribe, Central Australia

IN *Natural Science* for April of this year (vol. x., pp. 254-263) we gave an account of the Horn Expedition to Central Australia, and drew special attention to the valuable anthropological observations of Mr F. J. Gillen. This gentleman's residence of fourteen years among the Aruntas of Alice Springs in Central Australia has enabled him to associate himself with them on terms of the closest intimacy, and he is looked on as a full member of the tribe. Since the Horn Expedition, three years ago, Professor Baldwin Spencer of Melbourne has been in constant correspondence with Mr Gillen, and has twice used the university vacation to revisit the district, although the heat during the summer months is exceedingly trying to any European. During the summer of 1896-7 Professor Spencer undertook the long and difficult journey to Alice Springs in order to witness the most mystic rite of the Aruntas, and the one of rarest occurrence, namely, the fire-ceremony, for which preparations had been made by the tribe for eighteen months beforehand. His unique experiences were communicated to the Royal Society of Victoria on his return, early in April, and the following interesting account is given in *The Australasian* for April 17, 1897:—

Within a mile or two of the picturesquely-placed telegraph station, with its tiny cluster of stone houses, the strange aboriginal ceremonies were to be celebrated, and here for four months Professor Spencer made his headquarters. In order to be at hand when all the rites were being performed, Mr Gillen and the professor occupied a wurley, built on the sacred ground of the natives, and provisions were brought out from the station. Driven to desperation by flies, which had to be actually brushed off every article of food while it was being put into the mouth, slowly grilling under the tropic sun, and choked by the clouds of dust which every gentle breeze raised, the two observers had to make notes, take photographs, and measure evil-smelling natives for scientific purposes, when other employment slackened. The uncertainty as to when and where the next ceremony would take place kept Mr Spencer and Mr Gillen at all times on the *qui vive*, and on several occasions they had to tear after the blacks at mid-day

over two or three miles of scrubby, stony ground, carrying heavy full-plate camera and notebook to get an accurate record of what was going on. In all, 200 photographs were taken under extremely trying conditions. It is little wonder that the many friends of Professor Spencer were rather shocked to see him looking so parched and sun-dried on his return to civilisation.

Initiation Rites.—The Arunta tribe, like several other Australian tribes, is divided into sections or classes, which are four in number. In their details the relationships of these classes are very complicated, and are fixed by definite rules which are carefully observed by the blacks. It may be briefly stated that a man must marry out of his own class, while the children belong to yet a third class, certain members of which class are then his tribal brothers and sisters.

There are four grades of initiatory ceremonies which an Arunta man must go through before he becomes a full member of the tribe. Up to about ten years the boy lives in the women's camp, and accompanies them in their search for such food as roots, seeds, grubs, and the like. His tribal brothers then paint him on the chest and back, and he is thrown up into the air and caught. This is supposed to be beneficial to his growth. After this he now lives in the bachelors' camp, and accompanies the bachelors on their hunting expeditions.

Eight or ten years later he has to submit to circumcision and subincision, as described by Dr E. C. Stirling and Mr Gillen in the results of the Horn expedition. After that he may take a wife, and engage in other ceremonies. In the tribes of the East of Australia this stage is marked off by the knocking out of one of the front teeth, a ceremony to which a good deal of importance is attached. Amongst the Aruntas, though a front tooth is occasionally knocked out, yet the habit seems devoid of any sacred import, and appears to be a survival, the meaning of which is forgotten.

Totem and Churinya.—When the candidate has reached thirty, or in some cases forty years, he takes part in two sets of ceremonies which extend over several months, and it was these ceremonies which Messrs Spencer and Gillen had such unique opportunities of observing. The first set deals with the various totems of the tribe. There are very large numbers of totems in the tribe, and to one of these each black owes allegiance, and may be called by its name. Some may be kangaroos, others native peach trees, others dingoes or witchetty grubs, and so on. It has long been known that the marriage rules of the Arunta were governed, not by the totems, but by the classes previously alluded to, and why certain persons are attached to certain totems is one of the most peculiar and important

results which Messrs Spencer and Gillen have obtained. Closely interwoven with the idea of the totem is the significance of the churinya, or sacred stones and sticks. These objects are flat, oval, or elongate pieces of stone or wood, carved all over with incised lines which, in the Central Australian tribes, are circles or segments of circles, while in Western Australia they take the form of zig-zag lines. Each man has his own churinya, which is apparently looked on as another embodiment of himself, and yet at the same time it possesses a mysterious sacred significance. The women and the uninitiated are not allowed to look at it. The carvings on the churinyas of persons of the same totem are very similar. The churinyas are not kept by the blacks to whom they belong, but they are carefully hidden in some definite locality by one or two of the old men, each totem having its own particular set of such stations. The blacks state that in the 'dream-times' of the far distant past, when their ancestors came into the country, those of each totem kept strictly by themselves. At this time they are not quite clear as to whether those whose totem was, say the wild duck, were really human beings, or partly the animals or plants the names of which they bear.

The lines of these migrations are related in great detail in their traditions, and each camping ground is exactly located, so that the whole country is interlaced with lines of route, and dotted over with innumerable camps. When one of these 'dream-time' ancestors died, he was turned into a spirit-child, and as such dwells near one of the camping grounds, always carrying in his hand one of the churinyas. Conception is believed to take place by the entry of one of these spirit-children into the mother, the spirit-child dropping his churinya on the ground at the time. On the birth of the child the place is searched for the lost churinya, and by the kindly offices of one of the old men the search is usually successful. If it be not, a wooden one is made of hardwood, such as mulga. The stone churinyas are the more ancient form, and do not appear to be made at the present day. This then fixes the totem for the individual, and explains why in the Arunta tribe the child is not of the same totem as one of the parents, as is the case in some of the neighbouring tribes of Central Australia.

The members of each totem have a ceremony connected with their totem, which they alone are allowed to perform, and which has for one of its objects the increase of the animal or plant from which the totem takes its name. The eating of this animal is not tabooed to those who bear its name, as is frequently the case in other parts of the world; in fact, it is considered necessary for the chief performer to eat a portion of his totem, or the ceremony will fail.

General Programme.—In their general plan these ceremonies are much alike. The chief performer is elaborately decorated with patterns in eaglehawk down stuck to his body with blood drawn from some member of the party. This down is coloured red and yellow with ochre; other parts of the body are smeared with a black pigment mixed with grease. The amount of blood drawn on these occasions is at times surprising, it being estimated that one man allowed five half-pints to be taken from him during a single day. The decoration of this performer is completed while the black candidates, if they may be so termed, are away hunting. On their return to the sacred ground they dance vigorously round him for some time. In most of these performances the decorated men then imitate the actions of the animal whose totem they bear, and in some cases the acting is described as wonderful. In one mock combat two performers represented two eaglehawks struggling for a bone, and wildly flapping their wings, which were represented by a bunch of gum leaves in each hand.

The 'parra,' or sacred ground, was laid out with great care, and one of the most peculiar sights was to see the candidates lying in a row with their heads close to a long bank of earth, as they were required to do during most of the nights. Absolute silence was entailed, and the strain during the months through which the ceremonies lasted must have been great, and have considerably influenced the hysterical, exalted frame of mind which they at times showed.

Fire Rites.—After a month devoted to preliminary rites the fire ceremonies began. The men to be initiated formed into a body, and, holding a shield of gum leaves over themselves, went to the women's camp. They were accompanied by a number of the old men swinging bull-roarers. This seems to be the only occasion on which the women, on hearing the dread sound, do not run and hide themselves, nor are they at any other time allowed even to gaze upon the sacred implement. The women who were prepared, ran at the body of men, and threw burning branches on to them, which the men tried, not very effectually, to ward off with their roof of leaves. This ceremony was repeated daily for about a fortnight. Next, a large fire, about twenty feet across, was made and covered with green leaves; on this terrible heap the candidates lay for some time, several at once, others calmly standing by and waiting their turn. The heat of the fire was very considerable. Professor Spencer knelt on the heap to try it, but could not endure it, even with thick trousers on. This performance was concluded by all present howling and hurling firesticks about.

During the evening, when all the candidates were lying in a row as usual, one of the old men seated himself before them with a

decorated piece of wood which he held upright, and slowly and steadily knocked on the ground. At each side of him another old man sat holding his wrist, and assisting in this wearisome work, which, with most remarkable endurance, was kept up without a pause from half-past nine at night till about five next morning.

The number of candidates was very large, there being more than a hundred who were initiated. On the day following the final ceremony took place, the men crossing over to the women's camp, and each kneeling on a fire there.

Concluding Notes.—Each of the old men who were directing operations had men of his own totem under his charge, and for their proper initiation he was responsible. During the whole period of nearly four months they were not allowed to speak to him. At the conclusion of the rites they had to bring him some food-offering, such as cooked wallaby, and begged him to make them speak. He then touched their lips, and the ban of silence was removed.

A good deal of the significance of many of the ceremonies has probably been lost, but their main object seems to have been to test the endurance of the young men, and to teach them the past history of the tribe, while the possession of a knowledge of the correct method of procedure by the old men, who practically formed a council for the administration of the whole series of rites, would naturally cause them to be held in high esteem.

As this ceremony is only performed at intervals of many years, it is more than likely that, with the advance of the white man, the present may be the last occasion on which it will be performed with the completeness in which it was witnessed by Professor Spencer and Mr Gillen. The results so laboriously obtained are consequently of peculiar value. *θ.*

SOME NEW BOOKS

The Structure of Corals

Microscopic and Systematic Study of Madreporarian Types of Corals. By Miss Maria M. Ogilvie, D.Sc., *Phil. Trans. Roy. Soc.*, London. Vol. 187, 1896, pp. 83-345. Price, 11s. 6d.

Miss Ogilvie's work on the microscopic and systematic study of Madreporaria, read before the Royal Society in November 1895, was a long time in appearing in print. It is a copious and an ambitious work, one which reflects great praise on the industry and the capacity of the authoress, yet, as must always be the case in a work of such pretensions, it is open to a considerable amount of criticism in details. To criticise it adequately one would have to enter into minutiae which are of little interest except to the specialist; to criticise it at all one must necessarily enter into details which are unfamiliar even to zoological readers, unless they happen to have made a special study of corals.

It is well known that the stony corals, though they present but a limited range of structural peculiarities, are so rich and various in detail and display such infinite variety of form, that their classification presents great difficulties. These difficulties have been enhanced by the fact that even now the anatomy of the polyps is only known for a relatively small number of forms, and that there is a vast assemblage of extinct corals of which we only can know the structure of the skeletons: the nature of the polyps to which the skeletons belonged can only be inferred from the small knowledge we have of the anatomy of recent types. A great number of the palaeozoic forms of corals appeared to differ so much in their characters from later and recent corals that they were classified apart by Milne Edwards and Haime under the names Rugosa, Tabulata, and Tubulosa. The groups Tabulata and Tubulosa have disappeared some time since, but the group Rugosa has remained, in spite of the fact that several authors, but especially Gottlieb von Koch, have shown that the intimate structure of the coralla of many Rugosa is in all essential characters the same as that of recent corals. The group of Rugosa has survived, against the better judgment of many investigators, because it was convenient to palaeontologists, and in the study of corals as in that of many other groups, palaeontologists and zoologists have worked with too little heed to each other's doings. Miss Ogilvie writes as a palaeontologist, but as one whose ideas are moulded by the teachings of zoology. A great part of her work refers to the structure of recent forms, and her conclusions as to the nature and systematic position of ancient corals are founded on the knowledge which she has gained from her studies of living forms. The result is that she has turned the old classification of Milne Edwards and Haime upside down, and even those who have accustomed themselves

to the modifications introduced by Martin Duncan and Quelch will scarcely recognise the classification set forth in a very ingenious diagram on page 331 of this work. Corals are divided into two sections, Zaphrentoidea or Madreporaria Haplophracta and Cyathophylloidea or Madreporaria Pollaplophracta. The former section is divided into two sub-sections, the Coenenchymata, including the families Poritidae, Madreporidae, Pocilloporidae, Oculinidae; and the Murocorallia, including the Zaphrentidae, Turbinolidae, Amphiastraeidae and Stylinidae, the two last named being new families, or nearly so. *Euphyllia* is taken as the living type of the Amphiastraeidae, *Galaxea* of the Stylinidae. The section Pollaplophracta is divided into two sub-sections; the Septocorallia, including the families Cyathophyllidae, Astraeidae and Fungidae, and the Spinocorallia, including the family Eupsammidae. It will be seen that the old groups of Aporosa and Perforata as well as the Rugosa disappear altogether; that corals which were known as perforate are placed alongside of aporose corals and *vice versâ;* thus the Eupsammidae are ranked near the Astraeidae, the Pocilloporidae near the Madreporidae.

These sweeping changes are based upon a microscopic examination of the coralla of many recent and extinct forms. Make a section through a coral skeleton and you will recognise in the middle of each septum, or other component, a dark line or centre. With thin sections and high powers the dark line resolves itself into a series of dark spots, from which the crystalline elements of the corallum radiate outwards in diverse ways. A close comparative study of these features has convinced Miss Ogilvie—or we should rather say now, Mrs Gordon—that they afford a new and natural basis for classification, one which is applicable to the study of both extinct and recent corals, because the feature in question is usually well preserved in fossil remains. A further convenience is the fact that the microscopical structure of the corallum may often, if not always, be inferred from its superficial characters, *e.g.* granules, striae, and serrations of septa. To give details of the septal characters is here impossible; the structure is intricate and demands much space for explanation. It need only be said that anybody, having read this part of the work, may easily verify the truth of the statements made. Points which have hitherto escaped notice are here brought forward for the first time, and the new observations are invested with an importance which, if not always acceptable, is invariably interesting and suggestive.

Miss Ogilvie not only describes the microscopic character of the corallum; she also accounts for it by seeking to prove that the ultimate elements of the coral skeleton are minute scales, each composed of a bunch of minute crystalline fibres, and that each such scale is in fact a calcified cell or calicoblast, which is bodily converted into the calcareous tissue of the skeleton. In making this assertion Miss Ogilvie treads on contentious ground. She adopts and expands a view originally put forward by von Heider, but not generally accepted, because it appeared to be negatived both by examination of fresh adult coralla and by the embryological researches of von Koch. The latter author, whose statements are worthy of the utmost credit, states most positively that in the development of *Astroides calycularis*, the first

deposit of calcareous tissue takes place *between* the basal ectoderm and the surface of attachment, and that it is secreted by, not formed within the ectoderm cells. These statements are confirmed by H. V. Wilson for *Manicina areolata*, and in a question of this sort it requires very strong evidence to upset the proofs from embryology. Miss Ogilvie's evidence is hardly strong enough; the appearances which she describes are not unfamiliar to students of corals and are susceptible of a different interpretation, but she has at least reopened the question, which will have to be settled on better evidence than that which she has adduced.

Amongst the many figures which illustrate the work there are several showing the relations of hard and soft parts in recent corals. Some of them are correct, others are misleading, if not positively incorrect. Take, for instance, the diagram of *Turbinaria* on p. 209. The anatomy of this genus has been thoroughly described by Dr Fowler, and we learn from him that there is a system of canals which permeate the corallum and communicate with the polyp cavities. These canals anastomose freely, but Miss Ogilvie's figure shows only a few digitate or branched diverticula; no anastomoses, no network, and no transverse communications with the polyp cavities. The figure of *Fungia* on p. 169 can only be called a diagram of theoretical relations. As a matter of fact the soft parts of *Fungia* have not the structure shown in the figure. Miss Ogilvie homologises the tissues on the aboral face of *Fungia* with the edge-zone of other corals. This is right enough, but it is not right to assume, as she does, that there is no communication between the synapticula and through the theca between the cavity of the edge-zone and the general cavity of the body. As a matter of fact definite canals pass between the synapticula, some are united below the level of the synapticula by a radial canal, some are directly continuous with the cavities of the edge-zone. The mesenteries are best developed above the synapticula, but some extend also between and even below them, the rule being that the mesenteries are attached to synapticula, either above or at their sides, but some extend far down and send narrow mesogloeal bands to be attached to the basal wall of the disc. Other features, such as the position of the tentacles, are not correctly represented. The writer has the more confidence in making these statements since he has recently examined the anatomy of *Fungia*, in order to test the correctness of this figure. One is inclined to suspect that Miss Ogilvie, whilst making plentiful use of the anatomical researches of other authors, has not herself any great familiarity with the structure of coral polyps. There is some internal evidence that, after deciding in her own mind how the corallum was formed, she has inferred the anatomy of the polyps from the microscopical characters of their coralla, without studying the actual relations in a sufficient number of instances. Such inferences are apt to be misleading. Whether this is the case or not, Miss Ogilvie has been led by her views on the formation of calcareous tissue to give a lively but an unlikely account of madreporarian development and evolution, an account which is in harmony with the figures criticised above, but which does not and cannot explain the diagnostic character of the Madreporaria Perforata of M. Edwards and Haime—viz. the presence of a complex canalicular system in the wall,

the septa and the coenenchyme. For her the form and structure of the calcareous laminae or bars are the result of foldings, wrinklings, and tuckings in and over of the flexible zooid. On p. 315 there is an imaginative description of the evolution of the madreporarian zooid, which is represented as pulling in and tucking up its body in various places, forming invaginations here, evaginations there, as if guided by some predetermined impulse, and we are to believe that the form of the corallum is determined by these almost purposive wrinklings and corrugations of the zooid, which fills up the cavities and folds of the creases in its body with calcareous tissue. References, scattered throughout the volume, to invaginations—a word, by the way, which is used in a most puzzling variety of meanings with regard to spatial relations—show that Miss Ogilvie is dominated by the idea that the wrinkling and pitting of the soft tissues was the antecedent, the formation of calcareous structures the consequent. The skeleton, it is true, is formed by the soft tissues, but it by no means follows that the form of the skeletal parts is the result of the pre-existing form of the soft parts. The two elements have been formed *pari passu*, changes in the one reacting upon the other, and the final shape and mutual relations are the result of a continuous correlated development of which we cannot affirm, at any given point, that the growth of the one part preceded or dominated the growth of the other. On Miss Ogilvie's supposition it is most difficult to account for the formation of the canal system in perforate corals, and we cannot but suspect that this difficulty has led to her giving a theoretical rather than an actual picture of the structure of *Turbinaria* and of *Fungia*. Not that *Fungia* is a perforate coral.

In classifying the Fungidae, Miss Ogilvie has left out of consideration the fact that the young *Fungia* is a true aporose coral, indistinguishable from a Turbinolid, even to the absence or at least the very slight development of synapticula. This fact points to a close relationship between the Fungidae and the Turbinolidae, yet they are classed far apart, the former among the Pollaplophracta Septocorallia, the latter among the Haplophracta Murocorallia. In fact, the more one examines the grounds of the classification adopted in this work the less satisfactory does it appear. The group Coenenchymata strikes one as purely artificial. The subsections Murocorallia and Septocorallia are founded on the presence or absence of so-called 'thecal' pieces. This is a partial revival of the classification proposed by von Heider and adopted by Ortmann, it has been severely criticised by von Koch and others, and it is not too much to say that it is founded on a misconception. There is no essential difference between 'thecal' and 'septal' structures. Both are formed in the same manner from the same regions of the polyp. In many forms sections taken low down in the corallum show an alternation of septal and apparently thecal pieces. Higher up it is found that calcareous lamellae project inwards from the supposed thecal pieces, so that the last named appear as septa. The same coral appears to have an 'eutheca' in one part, a 'pseudotheca' in another part, is therefore a Murocorallian in one region, a Septocorallian in another. This fact has been repeatedly emphasised by von Koch, and a clear and convincing discussion of the question is to

be found in his recent work in Gegenbaur's "Festschrift." The Turbinolidae are a standing example of the unreliability of a classification founded upon the supposed difference between an Eutheca and a Pseudotheca. They are positively stated on p. 319 to have "a well built *theca*, whose fibrous elements are set in a direction at right angles to those of the septa." *Caryophyllia* is regarded as a typical Turbinolid, yet the writer has sections of *Caryophyllia smithii* which demonstrate conclusively that there are no such thecal pieces with fibrous elements set in a direction at right angles to those of the wall. The wall is in fact a typical pseudotheca, formed by the coalescence of the thickened peripheral ends of the septa. The same must be asserted of *Stephanotrochus* and others. Remembering that the wall of *Caryophyllia* is a pseudotheca, it is difficult to place *Flabellum* in the same group with it, and Miss Ogilvie's remarks on *Flabellum* suggest that she has not grasped the meaning of von Koch's argument that its 'theca' is in fact an epitheca.

It would not be difficult to find other materials for criticism, but enough has been said to show that Miss Ogilvie's more general conclusions must be received with caution. So long as she deals with the matter of her own original observations she is on safe ground, and in describing the finer structure of the corallum she has added largely to our knowledge, and has opened up a suggestive field of research. But she has marred her work by an effort to be too comprehensive, and in her attempt to form a complete system she has been obliged to rely on characters other than those which have been the object of her researches, and therefore has, in our opinion, been led into error. However extensive and excellent her work, it is not yet sufficient to allow of the making of a wholly new and general scheme of classification. But whilst one cannot accept the classification as it stands, one must feel that it abounds in suggestions. The suggested lines of descent of living from extinct forms, offer most interesting material for enquiry. There is an ingenious, but not wholly new, suggestion as to the probable relation of mesenteries in palaeozoic corals, involving an explanation of tetrameral arrangement of septa. The explanation of the nature of the fossula is ingenious and probable; unfortunately it is one of those points which can scarcely be proved by observation.

In conclusion, the work, though it may have defects, is a most useful one; it must always influence other workers in the same field, and it is probable that some of the main features of the classification will come to be universally adopted. One thing, at least, is certain, nobody will henceforth speak of the group of Rugosa.

G. C. Bourne.

R. Hertwig's Text-book of Zoology

Lehrbuch der Zoologie. By Dr R. Hertwig. Fourth improved edition. 8vo. Pp. xii. 612, with 568 text-figures. Jena: G. Fischer, 1897. Price in paper wrappers, 11 marks 50 pf.; bound, 13 marks 50 pf.

It is just two years since we reviewed the third edition of this clear and correct text-book, a fact that proves, at all events, the success of the work. The present edition differs from its predecessors, not only

in the slightly increased size, but in some extension of the parts dealing with the Sporozoa and the Vertebrata. The Sporozoa have of late years assumed great economic importance, especially in reference to the breeding of fish and to certain diseases of man, as was insisted on by Professor Ray Lankester in *Natural Science* for August 1896. Dr Hertwig has therefore done well to give them greater prominence. Among the Vertebrata, while Dr Hertwig has endeavoured to accommodate Boulenger's classification of the Reptilia to the restricted needs and limits of a text-book, he has found himself still unable to introduce the modifications in the classification of birds that have been held necessary by certain recent anatomists.

In our former review we alluded to the weakness of the palaeontological part of this otherwise admirable book, and we regret to find that weakness just as conspicuous. It leads to sins, not merely of omission, as the passing over of all the differences between an ammonoid and a nautiloid shell, and the absence of any account of the shell in the decapodous cephalopods, but also of commission, as the long obsolete division of the crinoids into Palaeocrinoidea and Neocrinoidea. A knowledge of palaeontology, too, would have saved Dr Hertwig from devoting space to the views of Haeckel on the Cystidea, when that space is so valuable that this most important class of all the echinoderms has to be dealt with in a dozen lines. We trust that the fifth edition, which is sure to be called for, will show some consideration to those extinct animals on the knowledge of which our classifications must ultimately depend.

Arthropods for Beginners

Through a Pocket-Lens. By Henry Scherren, F.Z.S. 8vo. Pp. 192. London: The Religious Tract Society. 1897. Price, 2s. 6d.

Mr Scherren is well known as a writer of attractive little books on natural history for beginners, and his reputation in this respect is not likely to suffer from the volume that is now under notice. Its object is to show how much may be learnt with an ordinary pocket-lens and simple appliances; but it is surely somewhat of a pity that the title is not more indicative of its contents. For the purpose could have been carried out with equal satisfaction if minerals, or any group of the smaller plants or animals, had been selected for study. As a matter of fact Mr Scherren's choice fell, and fell wisely, upon the Arthropoda, a group to which he has devoted much of his spare time, and which is peculiarly suitable for the purpose in hand on account of the abundance and obtrusiveness of its species, its attractiveness to young naturalists and collectors, and the extent of the variation in structure and habits that it displays.

The first chapter contains much useful advice on the question of lenses, needles, forceps, beakers, etc., showing that all needful appliances for the investigations illustrated in the following chapters of the book may be obtained by the expenditure of a small sum of money. In the way of lenses, however, there is one object which seems to have escaped Mr Scherren's notice, and to which he will perhaps be glad to have his attention drawn. This is the ordinary watchmaker's lens, which will be found invaluable for dissecting

purposes, since with a little practice it can be held in the eye, leaving the two hands free for the manipulation of the needles and forceps.

The types for study have been advisedly selected, being those, like the cockroach, water-beetle, garden-spider, and prawn, which can be obtained in almost every country district, or in any of our towns or their neighbourhood, and may very easily be kept alive in suitable surroundings. For one of the great merits of this little book is, that it recommends an observation of the habits of the species before they be submitted to the process of dissection.

The errors of the book are few and, on the whole, unimportant. It is not however usual to regard the carapace in the Crustacea as synonymous with the cephalothorax; and to say that the former consists of fourteen segments in the prawn, when it really represents the tergal elements of but two is misleading. Moreover, and since Mr Scherren—not without the countenance of authority—applies the word 'joint' to the internode or segment of a limb, it would be interesting to learn by what term the point of junction of two 'joints' is to be recognised. Lastly, Dr David Sharp will not be flattered by the ascription to him of the authorship of the 'Myriapoda' in the Cambridge Natural History. In spite of these blemishes, however, the book may be cordially recommended to beginners as an excellent practical lesson in the elements of the morphology and bionomics of the Arthropoda. R. I. Pocock.

For the Young Entomologist

Faune de France: Orthoptères, Neuroptères, Hymenoptères, Lépidoptères, Hémiptères, Diptères, Aphanipteres, Thysanoptères, Rhipiptères. Par A. Acloque. viii. and 516 pp., with 1235 figures. Paris: Baillière, 1897. Price, 8 francs.

The Young Beetle-Collector's Handbook. By Dr E. Hofmann, with an introduction by W. Egmont Kirby, M.D. 8vo. viii. and 178 pp., 20 coloured plates. London: Swan Sonnenschein & Co., 1897. Price, 4s. 6d.

The fauna of France in the groups mentioned above may be estimated at about 15,000 species, and M. Acloque disposes of them in this small volume. We have previously (*Natural Science*, May 1896, p. 346) explained the plan of the work, and need only add that, in the volume now before us, the necessity of keeping the number of pages within assigned limits has caused the author to abandon the attempt at dealing with species in the more extensive and difficult families; so that in these cases we find only tables of the genera.

In his preface the author recognises that this volume does not accomplish all that was intended when the scheme of dealing with the whole fauna of France in four small volumes was adopted. The system of terminations used in the names of the systematic groups is extremely repellent: the well-known family name Apidae becomes Apisidi; and as sub-family names we find Andrenii and Bombii, derived from Andrena and Bombus. Possibly the system is theoretically excellent, but it reminds us of Montgomery's lines about Nebuchadnezzar, who

> "murmured as he cropped the unwonted food,
> It may be wholesome but it isn't good."

Dr Hofmann's work is remarkably well printed, and the twenty

plates include about 600 almost tolerable figures. But the matter contained in the pages is somewhat disappointing. It consists of brief descriptions, and of an introduction, too short and vague to be of much use, dealing with more general points. D. S.

The Museums Association

Museums Association: Report of Proceedings with the Papers read at the seventh Annual General Meeting held in Glasgow, July 21 to 25, 1896. 8vo, pp. 167. London: Dulau & Co., 1896. Price 5s.

If anything were needed to show the growth of interest in the questions connected with the administration and development of museums it may be found in the institution and continued prosperity of the "Museums Association," and the issue of the compact volumes of papers read at their annual meetings. Last year's meeting took place at Glasgow, and for the first time since its foundation seven years ago the association had an "Art-man" as its president in the person of Mr James Paton, curator of the Kelvingrove Museum and Corporation Art Galleries in that city. In his presidential address Mr Paton gives an extremely interesting account of the institutions under his direction, but considering that the majority of his audience must have been men of science, I think that he might safely have omitted telling them that the aim of the picture gallery is "higher and holier," presumably from the context, than the scientific museum. Few scientific men are wholly blind to Art, many are in the highest degree susceptible to its influence, but all the same—comparisons are invidious!

Mr F. A. Bather's paper entitled "How may museums best retard the advance of science," being of a satirical vein throughout, is very entertaining reading; and, on the whole, I think we may give ready assent to most of the ideas which he has chosen this method of conveying.

Other papers in the volume are:—Mr H. Coates on the Arrangement of the Perthshire Natural History Museum; Mr E. M. Holmes on Type Specimens in Botanical Museums; Descriptive Geological Labels, by Mr H. Bolton; Mr F. A. Bather on Electrotypes in Natural History Museums; Mr G. W. Ord on Chemistry in Museums; Suggestions for a Proposed Natural History Museum in Manchester, by the late Prof. Huxley; Clara Nördlinger on a Visit to the Directress of the Schleswig-Holstein Museum; Illustrated Lectures in Art Galleries and Museums, by T. Rennie; and the Lighting of Museums, by Thomas White.

The perusal of these papers brings under our notice two important questions connected with museum economy. The first of these relates to Type Specimens. It is extremely desirable that all museums should publish catalogues of the types contained in their collections, and by many museums this has already been done. But the idea of bringing together all the type specimens in the kingdom, perhaps in the world, as some people possibly desire, is not only utterly impracticable, but from some points of view not even desirable. A little travel is not at all a bad thing for a zoological worker, and no doubt when he visits other towns and other countries for the purpose of consulting type specimens he will have the opportunity of enlarg-

ing his mind in other directions as well. At the same time it may be readily conceded that the possession of type specimens by small provincial museums in out-of-the-way places, is not for the advantage of science.

But perhaps of greater importance, from a general point of view, is the disposal of the exhibited collections for educational purposes.

The now well-known idea that the exhibited portion of a museum should be a collection of labels, illustrated by specimens, may be carried a great deal too far—so far as to upset the fundamental idea of a museum without attaining the object desired. Those who wish to study any particular branch of Natural History ought to find, in a well-arranged typical collection, where the specimens are provided with suitable descriptive labels, much invaluable assistance—but such labels can never supply the place of proper text-books, studied at home as well as in the museum or laboratory. We may take an example in this connection from Mr H. Bolton's set of descriptive labels for the geological collection in the Peel Park Museum, Salford, which are published in full in this volume. These labels are in themselves very good and praiseworthy summaries of the present knowledge of the geological formations in Great Britain, but to the serious student who possesses a good text-book of geology they are wholly unnecessary, while to those who, like most of the general public, are previously entirely ignorant of the subject, they must be utterly unintelligible. The use of a label is, I presume, to tell what a specimen *is and what it shows*, and not to enter into a dissertation on any general subject, that being the business of the text-book and of the teacher.

Mr Ord's plan for teaching chemistry by specimens, diagrams, models, and descriptive labels, is to my mind carrying the educational theory of museums to a pitch of absurdity. A collection of metals, salts, &c., is no doubt a desirable feature in connection with the chemical department of a school or college, but you will learn chemistry only in the laboratory, and certainly not in a museum.

But, however some of us may disagree with some of the notions of individual writers of papers in the present volume, the Museums Association is bound to do good by promoting the free discussion of the questions at issue.

R. H. Traquair.

The Geological Department of the British Museum

A Guide to the Fossil Invertebrates and Plants in the Department of Geology and Palaeontology in the British Museum (Natural History), Cromwell Road, London, S.W. 8vo. Pp. xvi. 158, with 182 text-figures. Printed by order of the Trustees, 1897. Price, 1s. ; also in two parts, price 6d. each.

This is a remarkable shillingsworth, so much so that anything less than effusive thanks for it smacks of ingratitude. Thanks, we are sure, the public will offer to the trustees, to Dr Henry Woodward, the popular keeper of the department, and to the able set of collaborators whose help he acknowledges. Only had the book been priced at five shillings or so could we have ventured on any criticism. We might then have asked for a little more co-ordination between the parts, a keener sense of proportion, and more careful selection of illustrations. With thirty-six pages devoted to the cephalopods, the

four other classes of the Mollusca might have had more than eight. We should not, even in a geological guide, expect to find the Brachiopoda and Bryozoa associated with the Arthropoda and Vermes as a 'Subkingdom Annulosa.' To balance the fifteen pages on sponges, or the seventeen figures of trilobites, we should have asked for more than twenty-four lines on those particularly interesting forms, the Cystidea and Blastoidea, especially as our national museum possesses not only a fine collection of these rarities, but an officer well qualified to deal with them. And, in the account of the sponges, one might have suggested that a simple division into Silicispongiae and Calcispongiae scarcely represented modern ideas of classification. Finally, we should have demanded very much better paper and printing; and even now we hardly consider that the get up of the work befits a great public department—it is certainly inferior to that of previous Guides.

But whether regarded as a text-book or as a guide there is no doubt that in many respects the work is a great advance on anything hitherto attempted at the price. We hope that the public will recognise this, and that the speedy exhaustion of the edition may pave the way for another with all the merits and without the few defects of the present one.

"PALAEONTOGRAPHICA" AMONG CRIMINAL LITERATURE

RELICS OF PRIMEVAL LIFE. By Sir J. W. Dawson, K.C.M.G., F.R.S. 8vo, pp. ix. 336, with 67 figs. London: Hodder & Stoughton, 1897.

SIR WILLIAM DAWSON'S book on "The Dawn of Life" having been for some time out of print, he has prepared the present volume to take its place. A good deal of the old matter and many of the illustrations therefore naturally reappear. The familiar story of the discovery of Eozoon, and of the spread of the belief in its organic structure, is again told, and Sir William Dawson refers to the principal criticisms on the other side. On pp. 273-274 Eozoon is made to tell the story of its own existence in an imaginary autobiography. It candidly admits its low intelligence and that it did not know whence it came; but "at length a change came. Certain creatures with hard snouts and jaws began to prey on me." Apparently the most objectionable of the hard-snouted generation was Möbius, whose work, in spite of its "large and costly figures" (p. 161), is described as valueless, owing to "that narrow specialism and captious spirit for which German naturalists are too deservedly celebrated." Möbius, according to Sir William Dawson, "did his best;" but so bad is his best that the publication of his memoir "was a crime which science should not readily pardon or forget on the part of the editors of the German periodical" in which it appeared.

Sir William Dawson does not give his opponents a very cordial invitation to continue the discussion, for he remarks in reference to the honest way in which Eozoon did his duty, that those who "dispute as to his origin and fate" are "much less perfectly fulfilling the ends of their own existence." So we will try to fulfil the ends of our own existence by discussing subjects in which an adverse verdict is not a "crime."

Our Naturalists

Mr L. Upcott Gill, 170 Strand, has kindly sent us "The Naturalist's Directory," 1897; price 1s. This, the third edition, will undoubtedly be useful to us, for it contains a large number of names that are not to be found in the ordinary lists of learned societies or in the invaluable "Zoologisches Adress-buch" of Friedländer. We presume the majority of those included in the above-mentioned works are here omitted of set purpose; there would be no difficulty in comprising them. At the same time, some hint might have been given as to the principles on which the selection was made. It is pleasing to find that there are so many people claiming to be naturalists in the British Isles. As for the foreign and colonial lists, their similar vagaries are perhaps due to the fact that they are avowedly restricted to persons desiring to correspond or exchange specimens with collectors and students in this country. The extension of these lists, no difficult task, would be of much use. The book also contains a trade-directory, a list of societies, field-clubs, and museums in the British Isles, a list of the principal natural history works published during 1896 in the British Isles, and a somewhat erratically selected but useful list of natural science magazines, in which, if we may judge from our own case, the information is not always so correct as it might be.

Botanical Bibliography

The Cambridge Botanical Supply Co. are distributing samples of their card catalogue of current literature relating to American botany. Items are arranged according to authors' names, but an edition of subjects is also in preparation. The matter is prepared by a board of editors, which includes the leading botanists of Columbia College, the National Herbarium, and other institutions, and is published under the direction of a committee of the American Association for the Advancement of Science.

The cards used are of heavy linen ledger paper made to order for this purpose. They are cut with extreme accuracy by an expensive machine. The size is 50 by 125 mm. The number of cards issued in 1894 averaged 49 per month; for 1895 the average was over 60, and the total number of cards to April 1897, 2319. Subscriptions ($5, paid in advance) may be sent to Wm. Wesley & Son, 28 Essex Street, Strand, London.

We commend this useful enterprise to the notice of the British Association for the Advancement of Science.

Westmorelandshire's Field Geology forms the subject of a paper by Mr H. G. Foster-Barham, which was read before the Burneside Mutual Improvement Society on February 11, 1897. The paper, which is illustrated by sketch-maps and sections, is published by R. Atkinson, Stramongate, Kendal, at 1s., post free, and gives a general account of the interesting district.

Scraps from Serials

The ever interesting *Scottish Geographical Magazine* gives two lively articles in its July number. Sir Henry Tyler writes on the

Geography of Communications, showing the enormous progress that has been made during the Victorian era, and Major A. C. Yates describes Loralai, a frontier cantonment in Baluchistan.

An article that should interest ethnologists is J. F. Hewitt's "The History of the Week as a Guide to Prehistoric Chronology," in the *Westminster Review* for July.

The *American Journal of Science* for July contains a description of *Ctenacanthus* spines from the Carboniferous Keokuk Limestone of Iowa, by Dr C. R. Eastman; a morphological account of two species of Cyperaceae, *Fuirena squarrosa* and *F. scirpoidea*, by T. Holm; contact metamorphism between slate and diabase in the El Pasco range, California, described by H. W. Fairbanks, who also writes on tin-deposits at Tenescal; notes on outliers of the Comanche series (Lower Cretaceous) in Oklahoma and Kansas, by T. W. Vaughan.

The July *Photogram* contains yet another article on the Photography of Birds' Nests, by Dr R. W. Shufeldt. An article on Technical Photography describes the studios of J. Bulbeck & Co. We should like to see something on the application of photography to the illustration of scientific papers. It is a failure in nine cases out of ten, no doubt, but whether it is worse than the ordinary draughtsman is a delicate point.

The *Irish Naturalist* for July is chiefly devoted to "Some Observations by English Naturalists (R. Standen, L. E. Adams, G. W. Chaster, and J. R. Hardy) on the fauna of Rathlin Island and Ballycastle District."

The Naturalist for July contains Mr John Cordeaux's Presidential Address to the Yorkshire Naturalists' Union. It deals with glaciers, plant-distribution, the antiquities of Holderness, and Yorkshire ornithology. Following this, G. O. Benoni encourages others by his example to take notes on natural history matters. One thing to be noticed is "the young oak thrusting up from [the field mouse's] abandoned home and store after a mild winter, as he stalks his rabbits down the woodside." It is indeed.

New Serials

Messrs Ginn & Co., Boston, U.S.A., announce *The Zoölogical Bulletin*, a companion serial to the *Journal of Morphology*, designed for shorter contributions in animal morphology and general biology, with no illustrations beyond text-figures. It is proposed to publish six numbers a year of about fifty pages each in the same form and style as the *Journal of Morphology*. The *Bulletin* will contain nothing but scientific communications. The editors are C. O. Whitman and W. M. Wheeler, assisted by a number of collaborators. The subscription price per volume of six numbers is $3.00, and single numbers are sold separately at 75 cents. each.

We have already announced the new quarterly *East Asia*, edited by Dr H. Faulds of Stoke-on-Trent, and published by Hughes & Harber of Longton, Staffordshire, at one shilling a part. The first number, published at the beginning of July, proves both entertaining and instructive. The chief articles are "Judicial Reform in China," by Dr Sun Yat Sen; "The Numeral System for the Blind in China," by Miss

C. F. Gordon-Cumming; "At a Japanese Barber's," by F. A. Bather; and an interesting account of "The Community in Cocos-Keeling and Christmas Islands," abstracted from a Blue-book. There is a list of recent books and magazine articles dealing with the far East. The Reviews and Notes would be better for more exactness of reference, and prices of books should be given. Anthropologists will find in this excellently printed journal many an item to interest them.

Further Literature Received

Synoptical Flora of North America, vol. i., pt. i., fasc. ii., A. Gray, ed. B. J. Robinson: American Book Co., New York. The Life-histories of the British Marine Food-fishes, W. C. McIntosh and A. T. Masterman: C. J. Clay. Traité de Zoologie, fasc. xi., xvi., ed. R. Blanchard: Rueff, Paris. Catalogus Mammalium tam viventium quam fossilium, ed. nov., fasc. ii., E. L. Trouessart: Friedländer. Thirty-first Ann. Rep. Museums and Lecture Rooms Syndicate, Cambridge. Ann. Rep. Raffles Library and Museum, Singapore, 1896. Third Rep. Whitechapel Public Library and Museum. Society for the Protection of Birds—Educational Series, No. 12.

The Reading of Words, W. B. Pillsbury: *Amer. Journ. Psychol.* Humanitarian League Correspondence. An Extraordinary Case of Colour Blindness, F. H. P. Coste (extract?).

Jersey Times, July 9; Amer. Geol., July; Amer. Journ. Sci., July; Amer. Nat., July; Annot. Zool. Japan, May; Feuille des jeunes Nat., July; Illinois Wes. Mag., June; Irish Nat., July; Journ. School Geogr., June; Knowledge, July; Literary Digest, June 12, 19, 26, July 3; Nat. Novit., June; La Naturaleza (Madrid), Nos. 18, 19; La Naturaleza (Mexico), No. 17; Naturalist, July; Nature, June 24, July 1, 8, 15; Nature Notes, July; Photogram, July; Rev. Scient., June 26, July 3, 10; Science, June 11, 18, 25, July 2; Science Gossip, July; Sci. Amer., June 12, 19, 26, July 3; Scot. Geogr. Mag., July; Westminster Rev., July; Proc. Biol. Soc., Washington, vol. xi., pp. 145-174; Bull. de l'Inst. Internat. Bibliogr., ii., fasc. 3; Trans. and Ann. Rep. Manchester Micros. Soc., 1896; Bull. Alabama Agric. Exper. Station, No. 80; La Bibliographie Scient., Bull. Trimestr., vol. ii., No 4; L'Année Biol., 1895.

NEWS

THE following appointments are announced :—

Dr J. Büttikofer, of the State Museum in Leiden, to be director of the Zoological Garden at Rotterdam; Dr Johannes Martin to be director of the Natural History Museum in Oldenburg; Dr W. B. Pillsbury to be instructor in psychology and director of the Psychological Laboratory in the University of Michigan; Dr Antoneo Crocichia to be professor of biology at the Catholic University, Washington; Prof. W. T. Engelmann to succeed the late Prof. Du Bois Reymond as professor of physiology at the University of Berlin; Adolf Beck, from professor-extraordinarius to professor of physiology at Lemberg; Mr Muir, of Halifax University, to be professor of psychology in Mount Holyoke College; Dr C. E. Seashore to be assistant-professor of psychology at the University of Iowa; E. M. Weyer and M. Matsumoto to be assistants in the Yale Psychological Laboratory; Jas. H. MacGregor to be assistant in zoology at Columbia University; Dr Ludwig Heim to be professor-extraordinarius of bacteriology at the University of Erlangen; Dr G. Boccardi to be associate-professor of microscopical anatomy at Naples; Dr J. J. Zumstein to be professor of anatomy at the University of Marburg; Dr Mayr to be prosector at the Veterinary College, Munich; Dr H. Baum to be professor of osteology at the Dresden Technical High School; Miss Mary E. Pennington to be Thomas A. Scott fellow in hygiene at the University of Pennsylvania; Dr Brault to be professor of tropical diseases at Algiers; S. I. Franz to be assistant in psychology at Columbia University; Dr T. Fuchs to be associate-professor of palaeontology at Munich; Miss Bertha Stoneman to be professor of botany in the Huguenot College for Women in Cape Colony; Prof. Georg Volkens to be assistant in the Botanical Museum of the Berlin University; J. R. Campbell to be lecturer in agriculture at the Harris Institute, Preston; Dr A. O. Kihlman to be assistant-professor of botany at Helsingfors; Herbert M. Richards to be tutor in botany at Columbia University; Dr J. Szadowski to be associate-professor of geology at Klausenburg; W. S. Boulton, of Mason College, Birmingham, to be lecturer in geology at University College, Cardiff; Dr Philippi to be assistant in the Geologico-Palaeontological Department of the Natural History Museum in Berlin; Frederick L. Ransome to be assistant geologist on the U.S. Geological Survey; T. I. Pocock, of Corpus Christi College, Oxford, to be assistant geologist on the Geological Survey of the United Kingdom; R. E. Dodge to be professor of geography at the Teachers' College, New York; Dr W. F. Hume and L. Gorringe to be assistants on the Geological Survey of Egypt; E. W. MacBride to be professor of zoology in McGill University, Montreal.

A BIOLOGICAL station will shortly be opened near Sebastopol.

A SUMMER school of biology on the Mississippi, not far from Monmouth, Ill., has been organised by Drs Maxwell and Swann.

THE Derby and Mayer Museums at Liverpool have acquired the fine collection of flint implements brought from Egypt by Mr Seton-Karr.

L'ASSOCIATION Française pour l'Avancement des Sciences meets at St Etienne, August 5-12, under the presidency of Prof. E. J. Marey.

ACCORDING to *Science* the University of Montana, at Missoula, has decided to erect a main building at a cost of $47,500, and a science hall at a cost of $12,500.

It is proposed to erect a monument at Moscow to the zoologist and anthropologist, Anatole Bogdanow, who died in April 1896.

A giant salamander of Japan, that had lived in the Jardin des Plantes for thirty-seven years, died on June 15, having a length of 1·30 metre and a weight of 24 kilograms. Two survivors mourn its loss.

Science states that a zoological club of nineteen members has been organised at Springfield, Mass., the president being W. W. Colburn, and the secretary Miss M. A. Young.

With reference to the note in our last number on the biological station at Plön, we now learn that the Prussian Government will assist it after October 1898.

An expedition, under the leadership of Mr C. M. Harris of Augusta, Me., and at the cost of the Hon. Walter Rothschild, is studying the fauna and flora of the Galapagos Islands.

An expedition to Okhotsk and Kamtschatka, under the leadership of K. Bogdanowitsch, has found gold at thirteen different places in the river-systems of the Jana, Kyran, Nemuj, Mute, and Lantar.

A botanical society, named after Baron F. von Müller, has been founded at Perth, W. Australia. Its president is Sir John Forrest, the indefatigable Premier, and its secretary, Mr Skews.

Sir Martin Conway and Mr E. J. Garwood have returned to Spitzbergen to continue the exploration of the interior of the main island. Afterwards they will go to Horn Sound and finish the exploration of the southern peninsula.

Science states that it is proposed to enlarge the Missouri Botanical Garden, by the gradual addition of 80 acres, of which 21 will be drained and graded during the present season.

Dr J. E. Humphrey, botanist, and Prof. W. K. Brooks, zoologist, are conducting a course of marine biology in Jamaica for students of Johns Hopkins University. The laboratory has formerly been at Port Henderson, on the south side of the island, but this year it is at Port Antonio, on the north.

The U.S. Senate has agreed to admit free of duty printed books over twenty years old, books in foreign languages and those devoted to scientific research, and books and scientific instruments imported for public and educational institutions.

Dr J. Walter Fewkes, of the Bureau of American Ethnology, is making a third expedition to the Pueblo Region, where, says *Science*, he will survey and excavate the ruins of Kintiel, near Navajo Springs, Arizona. He is accompanied by Dr W. Hough of the U.S. National Museum.

Messrs E. M'Ilhenny, W. E. Snyder, and N. G. Baxton have gone to Point Barrow to collect the fauna and flora of N.E. Alaska. *Science* hears that the collections will go to the National Museum, U.S., and the University of Pennsylvania.

A biological station, under the direction of Prof. C. W. Dodge, is to be established by the University of Rochester, N.Y., on Hemlock Lake. We have not yet heard that any fresh-water biological station is to be established in England.

The *Scottish Geographical Magazine* states that on May 8 an expedition under Lieut. Drizhenko left St Petersburg for Lake Baikal, which will be sounded and surveyed, while natural history collections will be made. The work will be continuedfor five years.

THE tenth congress of Russian naturalists and physicians, which was to have been held this August in Kiev, has, in consequence of the International Congresses of Geology and Medicine both meeting in Russia, been postponed till August 1898.

THE University of Pennsylvania is to have a new Museum of Archaeology and Palaeontology. The architecture, says the *American Naturalist*, will be in Italian renaissance style. A botanical garden, covering ten acres, will surround the museum.

THE International Postal Congress has decided that henceforth objects of natural history, animals, dried plants, or preserved zoological specimens may be sent as samples of merchandise, at ½d. for every two ounces, the maximum weight being 350 grammes.

ANOTHER expedition to Alaska is that of Dr W. H. Evans of Washington, who has gone to examine the agricultural resources of the district south of the Aleutian peninsula. Dr Sheldon Jackson goes on a similar errand to the Yukon basin.

THE Société helvétique des Sciences Naturelles holds its eightieth annual meeting at Engelberg, near Mt. Titlis, Sept. 12 to 15. The president of the annual committee is Dr E. Etlin, Sarnen, Obwalden, to whom those who wish to attend should apply.

MR R. H. KITSON, of Trinity College, has been awarded the Harkness Scholarship in Geology and Palaeontology at Cambridge University. Mr V. H. Blackman of St John's College and the British Museum, has been awarded the Hutchinson Studentship, for his researches on Algae.

THE Zoological Society of London has awarded its silver medal to Mr Alexander Whyte, recently naturalist to the Administration of British Central Africa, who has sent home large collections illustrating the fauna and flora of Nyassaland.

WITH reference to our note on the extinction of the bison (which some call buffalo), it is interesting to learn from *Nature* that a variety known as the 'wood-bison' is still to be met with near Fort Chipewyan, south of the Great Slave Lake, where it was seen in 1894 by Mr Caspar Whitney. There is no specimen in the British Museum. *Nature* says there ought to be, and so do we.

AT Danesdale, near Driffield, Yorkshire, are some 200 mounds, locally known as Danes' Graves. These have recently been excavated by Canon Greenwell, Mr J. R. Mortimer, and Mr T. Boynton, who have found remains of a chariot and various articles of iron and bronze, tending to show that the graves are of pre-Roman age, though more exact determination is at present not attempted.

GENERAL RUSSELL STURGIS has offered New York University a site on his estate at Hamilton, Bermuda, for the establishment of a marine biological station. Prof. C. L. Bristol, Prof. W. H. Everett, Dr Tarleton H. Bean, Dr W. M. Rankin of Princeton, and three students of the University have gone to prospect and to collect.

THE seventh session of the Australasian Association for the Advancement of Science is to be held at Sydney in the second week of January next, under the presidency of Prof. Liversidge. Capt. F. W. Hutton is to be president of the Geological section, Prof. T. J. Parker of the Biological, and Mr A. W. Howitt of the Ethnological.

A LIVING specimen of *Pleurotomaria beyrichi* was obtained last March by Mr Alan Owston of Yokohama, and was examined by Prof. Mitsukuri. It appears that two lobes, one on either side of the foot, envelop the shell to some extent, and

this may account for the fact that the shells of this genus are always very clean. The relations of the mantle to the slit on the outer lip could not be observed.

After descending Aconcagua, Zurbriggen and Mr Stuart Vines ascended the neighbouring Tupungato, which proved to be a volcano, 21,000 feet high. An active volcano was seen to the west.

Another large volcano, Orizaba, has recently been ascended by Mr K. T. Stoepel. Its extreme height is 18,333 feet, the length of the crater 1540, its breadth 1300, its depth 330.

With the idea that a fresh outlet may be provided for the grain-bearing provinces of Canada, an exploration of Hudson Bay is now in progress, under the command of Capt. Wakeham. Dr R. Bell and Mr Low, of the Canadian Geological Survey, will make geological and topographical surveys of the coasts and islands, while Capt. Wakeham on the *Diana* will investigate the navigability and fishing resources of the waters.

On August 10, Lord Kenyon, President of the Shropshire Horticultural Society, will unveil the statue of Darwin that has been erected by the Society at the entrance to the Public Library and Museum, the former school-buildings, of Shrewsbury. The statue, which is in bronze on a granite pedestal, is the work of Mr Horace Montford of Shrewsbury, and is not wholly unlike the fine statue in the Natural History Museum, London, though somewhat more alert in expression.

An influential meeting was held in the rooms of the Royal Geographical Society on July 5 to induce the Australasian Premiers to bring the subject of Antarctic exploration before their respective Governments. It was stated that the Society was prepared to contribute £5000 towards the amount subscribed by the Colonies. Eloquent and convincing speeches were delivered; but the Premiers were unable to be present.

Under the directorship of Dr T. Kochibe, the Geological Survey of Japan has been making good progress, and the staff has been increased. There has for some time been accumulating a collection chiefly illustrative of practical geology, and it is now proposed to build a proper geological museum in Tokyo. A short time ago some valuable phosphatic beds of Tertiary age were discovered along the north-east shore of the province of Kyushu, and Dr Tsuneto, of the Agronomic division of the Survey, has been experimenting with the material so as to make it available for the small Japanese peasant-farmers to use as manure. The organic remains in the deposit are those of marine invertebrates.

The Commissioners of the Whitechapel Public Library and Museum, in their third report, are glad to note the life infused into the museum by the Curator, Miss K. M. Hall. The average daily attendance is 275. A series of science lectures has been given free by eminent workers, and has been fully attended. Two exhibitions of spring flowers, and two of children's natural history collections, have been held. Twenty visits of classes from Elementary Schools have been made under Article 20 of the Education Code. The only thing in this report that is not satisfactory is the absence of *Natural Science* from the list of periodicals in the news-room.

Last October the Museum, Art Gallery, Public Library, and Technical Institute of Worcester, combined under the title of the Victoria Institute, were moved into a new building. It was soon found, oddly enough, that the space for the museum was less than in the old building, and it was necessary to appropriate the basement for the exhibition of the geological and ethnological specimens in spite of the little light available. This is a pity, for the local geological collection is a good one in itself, and further contains specimens of some historic interest from

the collections of Hugh Strickland, W. S. Symonds, and Wynnington Ingram. Among other collections in the Museum are one of local birds, and a good one of foreign marine shells the gift of the late Sir Geo. Whitmore. The heavy task of transferring and re-arranging all the material falls on the shoulders of the curator, Mr W. H. Edwards.

THE Zoological Museum of the Royal Academy of Science, St Petersburg, has acquired thirty-three specimens of fossil bones and numerous remains of Post-Tertiary mammals collected by J. Savenkov at Krasnoyarsk. Among them are some bones and a piece of skin of *Rhinoceros tichorhinus*, which were taken from a well-preserved specimen of a rhinoceros, covered with skin, found 60 versts east of Kasatschje, on the bank of the Charaula, a left tributary of the Tomskaja.

In the *Annuaire Géologique et Minéralogique de la Russie*, vol. ii. livr. 3-4, from which this news is taken, Marie Pavlov describes, with photographs, the occurrence of a mammoth (*Elephas primigenius trogontherii*) near the town of Yaroslavl, found during the making of a railroad, at a depth of 6 metres. The remains have been sent to the Geological Museum of Moscow University.

THAT there is still something new to be found in England is constantly being shown by the active members of the Hull Scientific and Field Naturalists' Club. The last item is the Moonwort (*Botrychium lunaria*), which Mr Waterfall has seen growing wild at York. Mr Fierke, in a lecture on crabs, gave a list of those found on the Yorkshire coast, and urged members to devote a little more of their attention to the rocks and pools of the sea-shore, where, we agree with him, they will find a rich field for useful work. The programme of excursions and meetings for July-September should induce a large number to join this vigorous body, which also holds out the inducement of a new and better room over a cycle shop.

AMONG those who received Jubilee honours were: Dr Edward Frankland, Dr Huggins, Mr J. Norman Lockyer, Dr Thorne Thorne, Mr Wolfe Barry, President of the Institute of Civil Engineers, and Admiral Wharton, Hydrographer to the Admiralty, to be K.C.B.; Mr W. H. M. Christie, Astronomer Royal, to be C.B.; Sir William MacCormac, President of the Royal College of Surgeons, Dr S. Wilkes, President of the Royal College of Physicians, and Mr Thos. Smith, Surgeon-in-ordinary to Her Majesty, to be Baronets; Sir Joseph Hooker and Lieut.-General Strachey to be G.C.S.I.; Mr William Crookes, President-designate of the British Association, and Dr Gowers, to be knights; Sir Herbert E. Maxwell to be Privy Councillor.

WE have received the report of the Raffles Library and Museum, Singapore, for 1896, by Dr R. Hanitsch. A number of new cases have been introduced, and the museum has undergone entire rearrangement. There is now exhibited the beginning of a collection of the local marine fauna. A shifting of specimens has also taken place, allowing more room to the birds and reptiles, and concentrating the ethnological collections. Owing to the absence of a workshop, the exhibition rooms had to be closed while the changes were in progress. Among the acquisitions of the museum is a specimen of *Madreporaria reticulata* (?), 4 ft. 5 in. by 2 ft. 8 in., picked up on October 20, 1896, by the Cable ship *Sherard Osborne* in the Bali Straits, at fifteen fathoms, where it had grown round a cable laid in 1888, thus giving another proof of the rapid growth of corals. Lieut. Harvey, R.E., lent a boat and crew for dredging excursions on several occasions, and other dredging trips were arranged by Mr G. Holt and the Committee. A zoological station has often been proposed, and is greatly needed; a simple movable shed, with plain furniture, jars, and preserving fluids, is all that is absolutely required.

MANY interesting matters are dealt with in the report of the Albany Museum, Cape of Good Hope, for 1896, to which we have already alluded in part. The alarming spread of insect pests in the Eastern province was thought to be largely due to the wholesale destruction of insectivorous birds. The protection of certain birds under an Act already existing was therefore recommended by the committee, who also suggested that saloon rifles, air-guns and catapults should be placed under the same restrictions as firearms. These proposals have been agreed to by the municipalities of Grahamstown, Port Elizabeth, Port Alfred, Uitenhage, East London, Somerset, East Cathcart, and the divisional Councils of Albany and Bathurst. The birds for which protection is desired are: Vultures, secretary bird, several hawks, especially the jackalsvogel (*Buteo jakal*) and the black-shouldered kite (*Elanus coeruleus*), owls, goatsuckers, swallows, kingfishers, hornbills, cuckoos, honeyguides, woodpeckers, barbets, thrushes (excluding fruit thrushes), warblers, sunbirds or honeysuckers, flycatchers, butcherbirds, crows (but not the rook), spreeuws (excluding redwing spreeuw *Amydrus morio*), larks, wagtails, plovers, and sandpipers. This list purposely omits rarities and game-birds.

Dr Schönland has started a small botanic garden for S. African plants, and intends to transfer these to the ground round the museum.

We are glad to see that the geological and mineralogical collections of the museum are being used for teaching purposes, since Dr Schönland lectures to those students of St Andrew's College, Grahamstown, who are studying for the first mining examination of the University of the Cape of Good Hope. This, it is hoped, will lead to more thorough geological examination of the surrounding country.

Dr Schönland has examined some peculiar rock-drawings in Bechuanaland, supposed to be the work of bushmen. They can, he says, only be looked upon as some kind of writing resembling to a certain extent early Semitic writing. An account of these, with photographs, was published in the *South African Telegraph*.

ON June 3rd a second expedition to make deep borings into the coral atoll of Funafuti set sail from Sydney. Towards the expense of this, Miss Eadith Walker, of Yaralla, has contributed £500; the Government of New South Wales has lent a diamond drill; the Hon. Ralph Abercromby has furnished an oil-engine at a cost of £100; the Hon. H. C. Dangar and Prof. T. P. Anderson Stuart have provided a fine boat; the Royal Society, London, contributes £100 directly, and probably another £100 through its coral-boring committee; finally the London Missionary Society has offered to bring the party back to Sydney in September. The expedition is under the auspices of the Royal Geographical Society of Australasia, and its leader is Prof. T. W. E. David, of Sydney. He and Mr G. Sweet of Melbourne are going at their own expense, and will take charge of the borings. Mrs David accompanies them as store-keeper and botanical collector. Mr W. Poole, an engineer of Sydney University, will manage the light boring apparatus, and will be aided by Mr Woolnough, who also takes charge of the zoological collecting. These gentlemen give their services free. The large diamond drill is in charge of Mr Hall, a foreman of considerable experience, who has under him two sub-foremen and three drill-workmen. In view of the difficulties already met with at Funafuti, a special boring plant has been provided under the direction of Chief-Inspector W. H. J. Slee, and weighs over 25 tons. The main bore, on the central island of Funafuti, will be begun with a standpipe having an inside diameter of 6 inches, and the lining pipe at first is to be 5 inches inside diameter. If, at two or three hundred feet, the friction should become too great, 4-inch pipes will be lowered inside these. It is thought that the foundations of the atoll will be reached between

200 and 500 feet, but the apparatus taken permits of a depth of 1000 feet being reached. The core obtained will be forwarded first to the Royal Society of London, which will return one-half to the Royal Geographical Society of Australasia. The expedition will also make smaller borings on the sand cay in the middle of the lagoon, will conduct dredging operations for Sydney University and the Australian Museum, and will collect samples of sea-water for Prof. Liversidge to examine for gold.

Our information is gathered from an article in the *Sydney Morning Herald* of June 3, kindly sent us by Mr C. Hedley.

From the thirty-first Annual Report of the Museums and Lecture Rooms Syndicate, Cambridge University, we glean the following information. The course in Botany is still largely attended, too largely for the accommodation; plans for enlargement of the buildings are under the consideration of the Sites Syndicate. The Herbarium has received a fine collection of Pyrenean and Alpine plants made by the late Chas. Packe of Christ Church, Oxford, and presented by his widow. Large collections of Canadian and Indian species have also been received. In the Zoological museum a fine adult male skeleton of *Balaenoptera musculus*, a specimen known as the 'Pevensey whale,' has been articulated by Mr E. Lane, and supported on iron-work designed by Mr W. E. Dalby. The collection of Polyzoa has been stored in the cabinet made after the pattern described by Canon Norman in the *Report of the Museums Association* for 1895. "I am confident," says Mr Harmer, "that anyone who tries this system will be grateful to Dr Norman for its excellence." Some such method of storing was much needed owing to the large increase in the collection of Polyzoa, mainly owing to the generosity of Miss E. C. Jelly. The series is very rich in Australian species, and excellently illustrates the papers of the late P. H. MacGillivray. Another notable addition is a series of slides of the appendages of cirripedes, made by Darwin when working on his well-known monograph. Unfortunately many of the preparations have greatly deteriorated. Prof. Mitsukuri, a former student, has presented some beautiful specimens of deep-sea hexactinellid sponges. The additions to the collection of Reptilia are noteworthy, including the large cast of *Iguanodon* presented by the King of the Belgians, a fine male of the rare *Testudo elephantina*, presented by the late Lord Lilford, a skeleton of *Gavialis gangeticus* from the Jumna, the gift of Mr E. H. Hankin, and many valuable skeletons sent from Borneo by Mr C. Hose. The trustees of the late Duke of Hamilton have presented the skeleton and skin of a bull from the Cadzow herd in Hamilton Park, believed to descend from the ancient wild cattle of Great Britain. These gifts, which at present stray into the lecture-rooms, render the enlargement of the museum a matter of pressing necessity. Dr Sharp states that Mr G. D. Haviland's collection of Termitidae, already alluded to by us, is the most valuable ever formed, for it almost doubles the number of known species. The professor of Human Anatomy remarks on the increase in the anthropology classes, due to the enthusiasm of Dr A. C. Haddon. Geology also continues to increase in popularity, and the want of space under which it has so long been suffering is naturally not less felt. The chief donation is that of several of Mr Whidborne's type and figured specimens, illustrating his monograph on the Devonian fauna of S. England. The list of books presented by Rev. T. Wiltshire is printed, and includes many rarities.

In our comment on willows last month (p. 14), we regret to have overlooked the fact that the growth of stamens inside the ovary in *Salix* had already been noted by the Rev. George Henslow. In his "Origin of Floral Structures" (p. 296, Fig. 78) he figures two antheriferous carpels of *Salix*, and one example of the same arrangement in *Ranunculus auricomus*.

CORRESPONDENCE

ANATOMY OF BIRDS

It is hard to be accused of heresy by one whose orthodox faith has been disturbed by his own misreading of a very good text. Mr Pycraft (*Natural Science*, vol. x. p. 415) complains of my having described "certain membrane bones, to wit, the maxilla, premaxilla, quadrato-jugal, and jugals, as modifications of the first visceral arch," and that this statement does not tally with the analytical diagram. (Article Skull, Newton's Dictionary of Birds.) Of course it does not, because that diagram is correct, and because I did *not* include the premaxilla and the maxilla as modifications of the first visceral arch. In my copy of the Dictionary (p. 872, line 5), the words "the right and left maxillae" are separated from what follows by a semicolon, and this alters the meaning of the sentence as much as the proverbial fly's dot in Hebrew texts. In the diagram the premaxilla and the maxilla are treated as visceral arches, just as they should be, but I am so orthodox, or courteous, as to leave to the palato-quadrato-mandibular arch its time-honoured name of first visceral.

Mr Pycraft would have done better not to mention Mehnert, as all "those who have given the matter their attention" ought to know, that Mehnert's conception of the pectineal process is erroneous, and this process is one of the chief clues to the homologies of the pelvic components.

Lastly, are not the Saxon terms "greater, middle, and lesser" as good as major, medium, and minor? And if the minor wingcoverts come too near the edge of the wing they become marginals, which as such, by the way, have been mentioned in the article "Tectrices."

However, I have no reason to complain of my reviewer. He has let me off kindly, and has drawn a veil over certain real faults which I should find it difficult to explain away.

H. Gadow.

Cambridge, *June 21st*, 1897.

THE OSTRACODERMS OF PROFESSOR COPE

In reference to Professor Ray Lankester's interesting note (*supra*, pp. 45-47) on the affinities of the early Palaeozoic organisms termed Ostracodermi by Cope, I regret that no new facts of fundamental importance for the discussion of the problem have been obtained since my brief summary published in *Natural Science* for October 1892. A re-statement of the basis of Cope's view would thus be merely a repetition of the facts and comparisons contained in the literature of the subject up to that date. I should like, however, to remark that neither Professor Cope nor I have ever placed the Ostracoderms in the Marsipobranchii. In the obituary notice of Cope, I expressly referred to them as 'allies' of those animals; and they have always been mentioned as at least a distinct sub-class. The chief difference between the views of Profs. Cope and Lankester seems to be, that the latter considers the unpaired character of the nasal aperture in the Marsipobranchii of fundamental importance, while the former regards it as a secondary specialisation of no notable significance from a phylogenetic standpoint. Prof. Cope believed that at the base of the craniate vertebrata, immediately below the true fishes, there could be recognised a class of organisms destitute both of the lower jaw and of paired limbs. He termed those the Agnatha, and eventually placed among them the two distinct sub-classes of Ostracodermi and Marsipobranchii. It still seems to me that this was a great step in advance towards the true phylogenetic arrangement of the lower vertebrata, and it was this that I ventured to 'acclaim' in the sentence which led to Prof. Lankester's protest. It is well that we who are accustomed to spend so much time in deciphering the tattered relics of extinct organisms in the rocks should occasionally be checked thus in our tendency to speculation; but, notwithstanding the imperfection of our materials, it becomes continually clearer as we proceed that Palaeontology alone furnishes the criterion for estimating the relative taxonomic value of the different morphological characters of any group of organisms that happen to possess hard parts capable of fossilisation.

A. Smith Woodward.

NOTICE

To Contributors.—All Communications to be addressed to the Editor of Natural Science, at 67 St James' Street, London, S.W. Correspondence and Notes intended for any particular month should be sent in not later than the 10th of the preceding month.